DOCUMENT RESUME

ED 074 223 VT 019 461

AUTHOR Harris, Marshall A.
TITLE Benefit-Cost Comparison of Vocational Education Programs. Statewide Evaluation of Vocational-Technical Education in Florida, Volume 2.
INSTITUTION Florida State Univ., Tallahassee. Dept. of Educational Administration.
SPONS AGENCY Florida State Advisory Council on Vocational and Technical Education, Tallahassee.
PUB DATE 72
NOTE 118p.

EDRS PRICE MF-$0.65 HC-$6.58
DESCRIPTORS *Cost Effectiveness; Educational Accountability; Educational Development; Educational Finance; *Formative Evaluation; Mathematical Models; *Program Costs; Program Effectiveness; Program Planning; Resource Allocations; *Statewide Planning; Student Costs; *Vocational Education; Vocational High Schools
IDENTIFIERS *Florida State Plan

ABSTRACT

This statewide study achieved the following objectives: (1) It developed a methodology for conducting a benefit-cost analysis of vocational education programs in Florida; (2) It examined, compared, and analyzed public and private costs and benefits of four Florida vocational programs, (3) It compared public and private benefits and costs for students enrolled in day high school with students not enrolled in day high school, and (4) It yielded mathematical formulas that resulted in the development of a model for predicting public and private economic returns of vocational programs. Current program cost data were incorporated with data collected by means of student followup questionnaires. Positive and significant rates of return were realized from public and student investment in each of the four selected vocational programs, with investments being recouped in less than two years. Of the four programs, only the air conditioning program showed statistically significant differences in rates of return on investments. Vocational students had higher rates of return than regular secondary students, although vocational student costs were greater. The methodology and the benefit-cost planning model proved effective and could prove useful in allocating resources to maximize public and student benefits. Development of vocational programs in Florida, especially in air conditioning, is recommended. This document is related to four others, available in this issue as VT 019 460, and VT 019 462-VT 019 464. (AG)

ED 074223

FILMED FROM BEST AVAILABLE COPY

VOL. 2

BENEFIT-COST COMPARISON OF VOCATIONAL EDUCATION PROGRAMS

Statewide Evaluation of
Vocational—Technical Education in Florida
Richard H. P. Kraft, Project Director

FLORIDA STATE UNIVERSITY
1972

VT 019 811

FILMED FROM BEST AVAILABLE COPY

Statewide Evaluation of Vocational–Technical Education in Florida

Included in the series:

1 AN EVALUATION OF THE FLORIDA STATE PLAN FOR THE ADMINISTRATION OF VOCATIONAL EDUCATION
Marshall A. Harris and
Malcolm C. McInnis, Jr.

2 BENEFIT-COST COMPARISON OF VOCATIONAL EDUCATION PROGRAMS
Marshall A. Harris

3 THE ROLE OF FLORIDA VOCATIONAL–TECHNICAL EDUCATION IN PROVIDING SERVICES FOR THE HANDICAPPED
Katherine Reapple

4 EXPECTATIONS AND SATISFACTIONS OF PARENTS AND STUDENTS WITH VOCATIONAL–TECHNICAL EDUCATION
Gordon S. Purrington

5 CONTINUED EVALUATION OF A MANAGEMENT INFORMATION SYSTEM FOR VOCATIONAL–TECHNICAL EDUCATION
Raymond F. Latta and
Max L. Schmidt

ED 074223

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

RECEIVED
FEB 09 1973
FLORIDA EDUCATIONAL RESOURCES
INFORMATION CENTER (FERIC)
DEPARTMENT OF EDUCATION

BENEFIT-COST COMPARISON OF VOCATIONAL EDUCATION PROGRAMS

Marshall A. Harris

Statewide Evaluation of
Vocational–Technical Education
Richard H. P. Kraft, Project Director

THE FLORIDA STATE UNIVERSITY
DEPARTMENT OF EDUCATIONAL ADMINISTRATION
1972

THE FLORIDA STATE UNIVERSITY

TALLAHASSEE 32306

DEPARTMENT OF EDUCATIONAL ADMINISTRATION

COLLEGE OF EDUCATION

July 19, 1972

Mr. John H. Hinman, Chairman
Florida State Advisory Council
on Vocational & Technical Education
Suite 752 - Tallahassee Bank & Trust
Tallahassee, Florida 32304

Dear Mr. Hinman:

The Study Group for Florida Statewide Evaluation of Vocational-Technical Education submits to you the following evaluation reports on Vocational-Technical Education in Florida for the school year 1971-72:

1. An Assessment of Goals and Priorities in Florida's State Plan for Vocational-Technical Education

2. Benefit-Cost Comparison of Vocational Education Programs

3. The Role of Florida Vocational-Technical Education in Providing Services for the Handicapped

4. Expectations and Satisfactions of Parents and Students with Vocational-Technical Education

5. Continued Evaluation of a Management Information System for Vocational-Technical Education

It is our hope that these reports will be helpful to all who are concerned with strengthening the State's comprehensive system of vocational-technical education.

Respectfully,

Richard H. P. Kraft

Richard H. P. Kraft
Associate Professor

RHPK/nm

VITA

Marshall Harris was born March 6, 1945, in West Palm Beach, Florida where he received his elementary and secondary education.

In June, 1967, he received a Bachelor's degree in Finance from the School of Business, The Florida State University, Tallahassee, Florida. Continuing his focus on finance, he graduated from the College of Education, The Florida State University, with a Master's degree in Educational Finance in August, 1968.

From September, 1968 through June, 1970, he was employed in positions related to educational finance with the State Department of Education of Florida and The Florida State University. From July, 1971 through August, 1972, he served as a Research Associate specializing in the economics of education in the Department of Educational Administration, The Florida State University. In August, 1972, he received his Ph.D. in the Economics of Education, The Florida State University.

Having published several papers related to the finance and economics of education, and to vocational education, he is presently employed as Coordinator of a Ford Foundation grant given to the Governor's Committee on

Education to study financial aspects of the public education system of the State of Florida.

TABLE OF CONTENTS

VITA ii

LIST OF TABLES vii

LIST OF FIGURES ix

Chapter

I. INTRODUCTION 1

Statement of the Problem
Purposes of the Study
Assumptions
Design of the Study
Need for the Study
Limitations of the Study
Definition of Terms

II. RESEARCH METHODOLOGY 12

Regional Demarcations
Selection of Programs
Study Participants
Time Period of the Study
Data Collection
Overview of Benefit-Cost Methodology
Methodology for Determining Program Benefits
  Public benefits of vocational education
  Private benefits of vocational education
  Relatedness index
Methodology for Determining Program Costs
  Public costs of vocational education
  Private costs of vocational education
Methodology for Determining Benefit-Cost Ratios
Statistical Techniques Employed

III. PRESENTATION AND ANALYSIS OF DATA 39

Description of Sample
Comparison and Analysis of Benefits
  Public benefits
  Private benefits
  Socio-demographic effects on benefits
  Relatedness index

Comparison and Analysis of Costs
Public costs
Private costs
Socio-demographic effects on costs
Comparison and Analysis of Benefit-Cost Ratios

IV. A BENEFIT-COST PLANNING MODEL 77

V. SUMMARY AND CONCLUSIONS 84

APPENDIXES

A. Follow-up Questionnaire 89

B. Cover Letter 91

C. Wage Rates for Unskilled Workers in Florida by Region 92

D. Average Public Costs per Full-Time-Equivalent (FTE) 93

E. Private Direct Costs per Full-Time-Equivalent (FTE) 94

F. Analyses of Variance of Means of Independent and Dependent Variables between Programs . . . 95

Scheffe's Multiple Test for Determining Differences of Means of Independent and Dependent Variables between Pairs of Programs 96

G. Chi Square Analysis of Qualitative Independent Variables between Programs 97

H. Analyses of Variance of Independent and Dependent Variables between Secondary and Nonsecondary Students 98

I. Multiple Regression Analyses of Socio-Demographic Effects on Public Benefits for Each Program 99

J. Multiple Regression Analyses of Socio-Demographic Effects on Private Benefits for Each Program 100

K. Multiple Regression Analyses of Socio-Demographic Effects on Hours of Attendance for Each Program 101

L. A Discussion and Correlation Analysis of the Relationship between Costs and Benefits 102

M. Multiple Regression Analyses of Socio-Demographic Effects on Private Benefit-Cost Ratios for Each Program 104

BIBLIOGRAPHY 105

12. Average Private or Student Benefit-Cost Ratios by Programs and by Secondary and Nonsecondary Students in All Programs 71

13. Summary of Multiple Regression Analyses of Socio-Demographic Effects on Private Benefit-Cost Ratios for Each Program 81

LIST OF FIGURES

Figure		Page
1.	Regional Demarcations of Florida	14
2.	Florida Area Vocational-Technical Centers	16
3.	A Benefit-Cost Planning Model	78

CHAPTER I

INTRODUCTION

In 1969 the Division of Vocational, Technical and Adult Education in the Florida State Department of Education received, under contract, a cost-effectiveness study of vocational education in Florida.[1] This pilot study advanced several empirical, methodological, and theoretical findings which encouraged and facilitated future evaluations which utilized cost-effectiveness techniques. One important empirical finding of this study revealed that vocational education does, indeed, have an economic payoff, and therefore should be considered a favorable medium for investing both public and private (student) resources. One methodological finding, however, warned of the difficulty of obtaining program cost information in Florida due to a financial accounting system which does not report cost data by programs.

Using similar techniques, another cost-effectiveness evaluation was conducted in Florida in 1971.[2] In order to

---

[1]Richard H. P. Kraft, Cost-Effectiveness Analysis of Vocational Technical Education Programs, Report to the Florida State Department of Education, Tallahassee, Florida, June 30, 1969 (Tallahassee: The Florida State University, 1969).

[2]Marshall A. Harris, "Cost-Benefit Analysis of Occupational Training Programs," in Perspectives on Progress: Career Education in Florida, ed. by Richard H. P. Kraft, Report to the Florida State Advisory Council on Vocational and Technical Education, Tallahassee, Florida, June 1, 1[illegible] (Tallahassee: The Florida State University, 1971).

overcome the obstacle of unavailability of cost data by programs, this study used estimated program cost data provided by institutional administrators and instructors, and State Department of Education estimated cost data prepared pursuant to legislation. An advancement of this study was that it included twenty-one different programs, whereas the pilot study included two programs. The findings of this later study validated empirical findings of the early study relative to the positive and significant economic value of vocational-technical education in Florida.

The present study of the economic returns from vocational education in Florida is larger in scope, more sophisticated in methodology, and has a better data base than either of the earlier studies. The effect of these advancements over previous studies is to produce not only more sound ex post evaluations, but also to facilitate ex ante evaluations. In other words, the present study goes beyond an assessment of what occurred in the past to provide procedures and data useful for planning for the future.

Statement of the Problem

Increasing public demands for educational accountability, and a persistent scarcity of resources, have encouraged administrators-economists to research and develop new evaluation and planning methods in order to allocate scarce resources to those programs which are most efficient. Since vocational education programs are considerably more expensive than conventional academic programs, the need for assessing

vocational education program costs and benefits becomes especially important.

Another dimension of educational accountability pertains to the need to provide advance information about the costs and benefits of vocational education programs to prospective students in order for them to make informed decisions relative to their vocational training choices, and thus their future occupations and primary source of income.

It is recognized that an important imperfection in estimating the returns to education is lack of information. In this connection, Renshaw says:

> . . . a potential . . . student (and society) really have no way of adequately appraising either the opportunity costs associated with various amounts and kinds of education or the prospective returns. At the margin, investment in . . . education is made pretty much on faith alone . . . .[1]

In view of the need to allocate scarce public and private resources the following questions were raised: (1) Do vocational education programs in Florida have positive benefit-cost relationships? (2) Do benefit-cost relationships between vocational education programs differ and do these relationships differ between individual students? and (3) Can the results of a benefit-cost analysis be used as an effective technique by educational planners and decision makers and by individuals anticipating enrolling in vocational education?

---

[1]E. F. Renshaw, "Estimating the Returns to Education," in Readings in the Economics of Education, ed. by Mary Jean Bowman (Paris: United Nations, Educational, Scientific, and Cultural Organization, 1968), p. 563.

Purposes of the Study

The purposes of this study were fourfold: first, it developed a methodology for conducting a statewide benefit-cost study of vocational education programs in Florida; second, it examined, compared, and analyzed the public and private benefit and cost aspects of four vocational education programs in Florida; third, it compared the public and private benefit and cost aspects of students who attended vocational education programs while enrolled in day high school and students not enrolled in day high school;[1] fourth, it yielded formulae which resulted in the development of a model for predicting public and private economic returns of vocational education programs.

The study examined economic factors in the following areas:

1. The public economic benefits and costs of vocational education.
2. The private or student economic benefits and costs.
3. The degree to which former vocational education students were employed.
4. The degree to which students were employed in occupations which were related to their vocational education programs.
5. The relationship between public costs and public benefits

---

[1]Students who attended vocational education programs while enrolled in day high school were referred to as secondary students throughout this study. Students who were not enrolled in day school were referred to as nonsecondary students.

and the relationship between private costs and private benefits.

6. Predicting models for educational planners and decision makers, and for students contemplating enrolling in vocational education programs.

Assumptions

1. There is a causal relationship between formal vocational education training and subsequent labor market performance of vocational education students.
2. Increases in wage rates and decreases in unemployment rates are satisfactory measures of economic efficiency benefits of vocational education.
3. An important objective of vocational education students is to secure employment in the field for which they were trained.
4. The number of persons moving in and out of vocational education is too small to affect relative wage rates and employment rates in respective occupations.
5. Analysis of cross-sectional and historical data provide useful estimates for projecting trends into the future.

Design of the Study

This study was concerned with statewide benefits and costs of vocational education programs in Florida. In order to account for the influence of regional price variations and regional labor market conditions and wage rates, the state was divided into major geographical regions. Within each region two institutions designated as area vocational centers

were randomly selected. Based upon stated criteria, four vocational education programs were included in the study.

Two methodologies for determining benefits and costs of vocational education programs were developed. One methodology was developed for determining public benefits and costs. A second methodology was developed for determining student benefits and costs. Both methodologies incorporated existing program cost data and data collected by means of follow-up questionnaires mailed to former vocational education students.

Benefit and cost data were collected and analyzed in two forms. In one form were the benefits received and the costs incurred by society (public benefits and costs). In another form were the benefits received and the costs incurred by students (private benefits and costs).

Using statistical techniques of simple correlation, analysis of variance, chi square, and multiple regression, separate analyses of benefits, costs, benefit-cost ratios, and the relationship between costs and benefits were performed.

As a result of the ex post evaluations, linear equation models for projecting returns on investment in vocational education were developed.

Need for the Study

1. As educational funding decisions move more toward the state level, it becomes increasingly important for legislators and state level educational administrators to make informed recommendations and decisions regarding educational appropriations. However, present fiscal accounting

and budgeting systems do not provide adequate information on education program benefits nor on program costs.

2. Presently the state funding formula for vocational education bears little relation to actual program costs. In 1971, legislation was passed in Florida requiring that program cost data be collected on vocational education programs offered at area vocational centers in order that future funding may be based upon actual costs of programs.[1] Since vocational education program costs for the same unit of time vary greatly between different vocational education programs,[2] there is a need to link program benefits with program costs in order to make effective allocation decisions. This study provides an analytical approach toward providing current and future information on the benefits and costs of vocational education programs.

3. In 1970, the Vocational Subcommittee in the Florida House of Representatives recommended that:

> . . . the State Board of education be directed to develop a uniform information system for all public education, emphasizing output information. Special emphasis should be placed on vocational education, and such a system should include occupational placement information by on-the-job studies of graduates and non-graduates, and an analysis of course and program productivity.

4. In order to meet the needs of vocational education or prospective vocational education students, Part I--

---

[1]Florida, Finance and Taxation: Schools, Statutes (1971), I, 1150.

[2]For example, a study of vocational education program costs submitted to the Division of Vocational, Technical and Adult Education reports costs ranging from $396 per FTE for a roofing course to $4,312 per FTE for a data processing course.

Continuing Administrative Provision of the Florida State Plan for the Administration of Vocational Education states:

> . . . the State Board and local educational agencies will establish and maintain vocational guidance and counseling services designed to (among others):
> 1. Provide persons with information needed for making informed and meaningful occupational choices.
> 2. Determine the effectiveness of vocational instruction and guidance through appropriate follow-up activities.[1]

5. In 1971, the Florida State Advisory Council on Vocational and Technical Education recommended that a cost-benefit analysis of vocational education programs at the secondary and post-secondary levels be performed. "One objective would be to contrast the economic efficiency of programs by level."[2]

Limitations of the Study

An economic study of vocational education programs like a benefit-cost analysis captures only a portion of the total benefits resulting from vocational education. Since benefits of vocational education programs exist in both monetary and non-monetary forms, a benefit-cost analysis which considers only monetary benefits is necessarily only a partial analysis of the total benefits of vocational education programs.

In addition, monetary measures of benefits of

---

[1]Florida, Florida State Plan for the Administration of Vocational Education, Part I (1971), p. 36.

[2]Annual Report of the Florida State Advisory Council on Vocational, Technical Education (Tallahassee, Flor[illegible] author, 1971), p. 2.

vocational education programs are dependent upon the operation of labor market mechanisms to provide data. Any imperfections in the labor market will also appear in the monetary measures of benefits. The amount of increases in monetary measures of benefits that accrue to persons after vocational training is difficult to determine, since normal maturation processes and shifts in individual wants and desires occur from the time a person enters vocational training until his monetary benefits are measured.

Definition of Terms

Since definition of words sometimes have unique disciplinary connotations which directly affect the contextual interpretation of a study, the following definitions are used uniformly in this study.

Benefits.--The economic benefits of vocational education are defined as the change in economic welfare of society (public benefits) and the individual student (private benefits) caused by vocational education. Another measure of benefits used in this study was the relationship of post-vocational employment to the vocational education program.

Benefit-Cost Analysis.--An analytical, economic approach for evaluating and projecting the economic returns of students who attended vocational education programs is a benefit-cost analysis.

Costs.--Economic costs of vocational education are incurred either by society (public costs) or by students (private costs). Economic costs include both direct costs

(tax support by society and costs for tuition, books, supplies, uniforms, and special equipment incurred by students), and indirect costs (opportunity costs of foregone benefits on alternative investments).

Economic Returns.--Returns on investment in vocational education as measured by a benefit-cost ratio are designated economic returns. This also refers to the economic efficiency of vocational education programs in achieving employment objectives.

Full-Time-Equivalent (FTE).--Eight hundred ten student hours of attendance comprise one FTE. This is based on five hours of attendance per day times 180 days, less a 10 per cent absentee and withdrawal factor or: (5 x 180) - 90 = 810.

Dependent Variables.--Seven dependent variables were used in this study. They were: (1) public benefits, (2) private benefits, (3) public costs, (4) private costs, (5) public benefit-cost ratios, (6) private benefit-cost ratios, and (7) relatedness index (relationship of post-vocational employment to vocational program attended). Involuntary unemployment was also a dependent variables, but since it entered into the calculation of benefits, it was not considered separately.

Independent Variables.--Independent variables are the socio-demographic characteristics of students which include: region where trained and employed; working experience; relatedness index; additional training; race; secondary student; fathers lived with family for majority of student's elementary and secondary school years; marital stuatus; father's

income and education; mother's education; hours of attendance in program; involuntary unemployment; age; number of children; high school level completed; and high school grade point average. In the regression analyses, relatedness index and involuntary unemployment were used as independent variables.

Private.--Private is defined as being synonymous with student, and these terms are used interchangeably. For example, private benefits or student benefits.

Public.--Public is defined as being synonymous with society, and these terms are used interchangeably. For example, public benefits or social benefits.

CHAPTER II

RESEARCH METHODOLOGY

This chapter presents the research methodology used in the study in terms of: (1) regional demarcations; (2) selection of vocational education programs; (3) study participants; (4) time period of the study; (5) data collection; (6) an overview of the benefit-cost methodology; (7) methodology for determining benefits; (8) methodology for determining the relationship of employment to vocational education training; (9) methodology for determining costs; (10) methodology for determining benefit-cost ratios; and (11) statistical techniques employed in the study.

Regional Demarcations

The procedure for selecting the programs which were included in the study was based upon the notion that different geographical regions in Florida have varying price levels which directly affect the cost (public and private) of given vocational education programs. Additionally, different geographical regions have different labor market conditions which affect wage and employment rates of persons in the labor force who took vocational training.

Therefore, delineation of Florida into major geographical regions was the first procedural step. The state

was divided according to major economic and population centers which resulted in the four geographic regions delineated in Figure 1. Demarcation of geographic regions were as follows: northwest and north Florida; central Florida; southwest Florida; and southeast Florida.

Selection of Programs

Determination of the kind of programs to be selected for study was the next procedural step. Five criteria were developed for this purpose. (1) Only programs offered in institutions designated as area vocational centers in Florida would be included. (2) A minimum of fifteen full-time-equivalent (FTE) enrollment for the years 1968 through 1971.[1] (3) A mix of programs to include both males and females would be selected. (4) Programs must have served both secondary and nonsecondary students. (5) All area vocational centers must offer at least two of the programs selected.

Using statewide vocational education program data collected by the Florida Division of Vocational, Technical and Adult Education, five programs were selected which met the stated criteria. They were: electronics, auto mechanics, air conditioning and refrigeration, cosmetology, and licensed practical nursing. While the electronics program was included initially, it was later excluded from the study

---

[1]Two reasons for limiting the follow-up period to three years were: (1) the longer persons have been out of school, the more difficult it is to locate them, and (2) the specific effects of vocational training tend to decrease over time relative to the actual effectiveness of vocational training on benefits.

FIGURE I

REGIONAL DEMARCATIONS OF FLORIDA

because the return of usable questionnaires was very low (less than 10%). The remaining four programs--auto mechanics, air conditioning and refrigeration, cosmetology, and licensed practical nursing--comprised the sample of the study.

Since not all area vocational centers offered all four of the selected programs, two area vocational centers from each of the four geographic regions were randomly selected.[1] Figure 2 shows the total population of the thirty-five area vocational centers in Florida by the geographic regions delineated in this study.

Study Participants

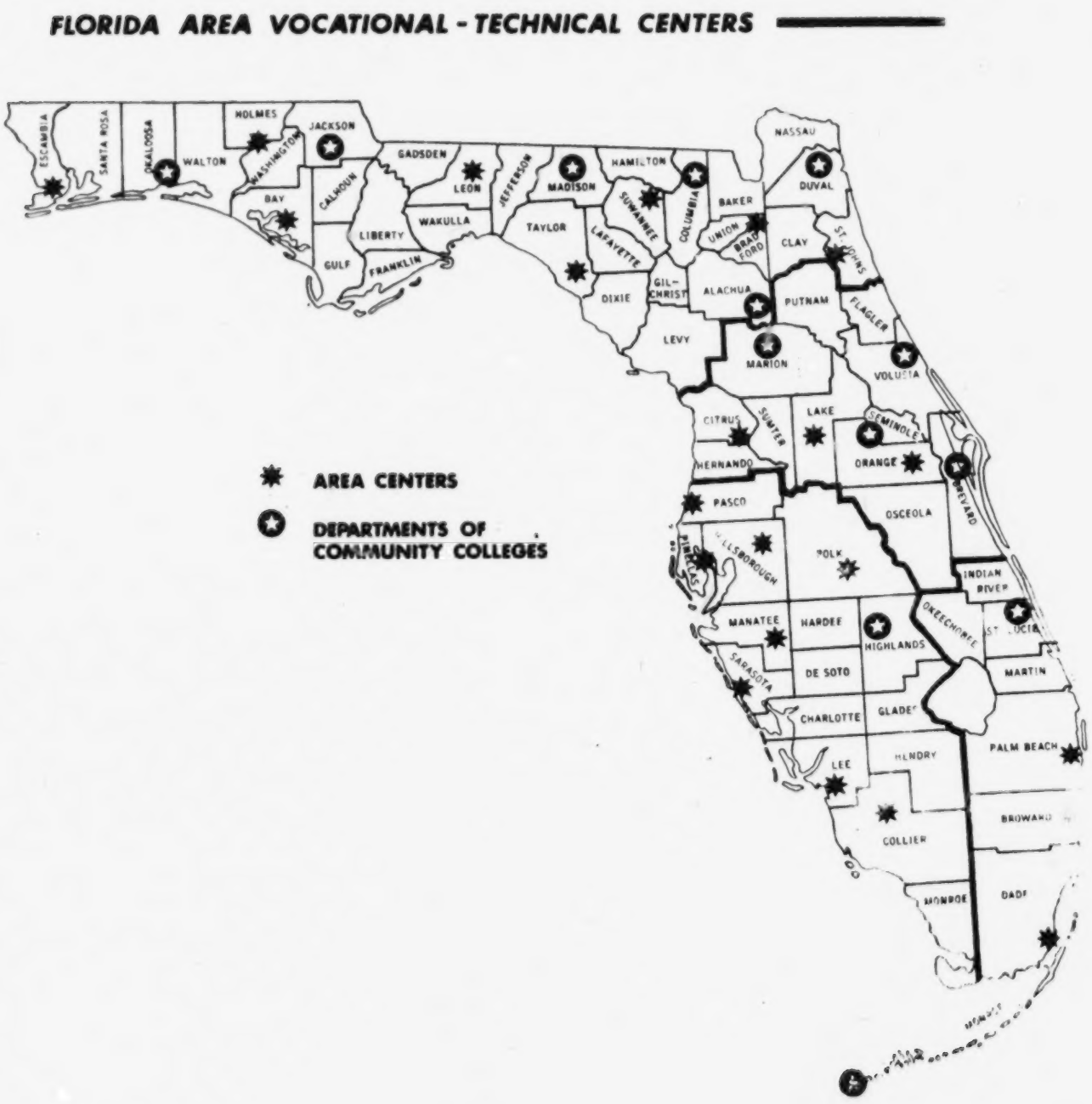
A previous cost-benefit study conducted in Florida revealed that many vocational education students did not remain in vocational training for the length of time scheduled for completion of the program. For example, in one graphic arts program, the scheduled number of contact hours for course length completion was 1080 hours. However, the actual average training length of all students was only 700 hours.[2]

---

[1]One area vocational center in central Florida which was selected chose not to participate in the study. Therefore, this school was removed from the total schools available for selection in central Florida.

[2]Marshall A. Harris, "Cost-Benefit Analysis of Occupational Training Programs," in Perspectives on Progress: Career Education in Florida, ed. by Richard H. P. Kraft (report to the Florida State Advisory Council on Vocational and Technical Education, Tallahassee, Florida, June 1, 1971; Tallahassee, Florida: The Florida State University, 1971), p. 72.

FIGURE 2


FLORIDA AREA VOCATIONAL - TECHNICAL CENTERS
AREA CENTERS
DEPARTMENTS OF COMMUNITY COLLEGES
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
WASHINGTON
JACKSON
BAY
CALHOUN
GULF
FRANKLIN
GADSDEN
LEON
LIBERTY
WAKULLA
JEFFERSON
MADISON
TAYLOR
HAMILTON
SUWANNEE
LAFAYETTE
COLUMBIA
DIXIE
GIL-CHRIST
LEVY
NASSAU
DUVAL
BAKER
UNION
BRADFORD
CLAY
ST. JOHNS
ALACHUA
PUTNAM
FLAGLER
MARION
VOLUSIA
CITRUS
SUMTER
LAKE
SEMINOLE
HERNANDO
ORANGE
BREVARD
PASCO
OSCEOLA
POLK
INDIAN RIVER
MANATEE
HARDEE
HIGHLANDS
OKEECHOBEE
SARASOTA
DE SOTO
MARTIN
CHARLOTTE
PALM BEACH
LEE
HENDRY
BROWARD
COLLIER
MONROE
DADE

Not needing the entire number of hours to fulfill their employment objectives, these early leavers (some of which are taking parts of the program for retraining purposes) very often enter gainful employment utilizing those skills acquired from the vocational training program.[1] Erroneously, these students have sometimes been categorized as "dropouts" while the fact may be that they are minimizing their training time and thus their costs, and yet still achieving their employment objectives.

Since these early leavers were found to have derived benefits from vocational education,[2] they were included in the sample of this study. The decision to include these types of persons as well as graduates required special consideration in the time period of the study.

Time Period of the Study

In order to follow up early leavers as well as graduates of vocational education programs, persons who either completed training or left early during the period from August, 1968 through September, 1971, were included in the study.

The common method of following a single cohort (for example, persons who either left the program early or who graduated in June, 1969) was rejected because (1) early leavers drop out at various times during the year, and (2) the number of persons completing training at area vocational

---

[1] Ibid., p. 94.

[2] Ibid.

centers at any given time was small compared to the number who graduate at various times during the year and the number who leave early during the year.

Instead of using a single cohort, a sample of all students who either graduated from or left the vocational education programs early during the period from August, 1968 through September, 1971 was used.

Since the time period of the study during which respondents could have participated in the labor force was August, 1968 through December, 1971, the longest possible time one could have participated in the labor force was thirty-eight months, and the shortest possible time was four months.

Data Collection

The main source of data for this study was follow-up questionnaires sent to former vocational education students. The questionnaire which appears in Appendix A was constructed by the author in order to obtain necessary information on the socio-demographic characteristics and labor market performance of former vocational education students.[1]

The questionnaire was pre-tested in Leon County, Florida, in September, 1971, using two faculty members at The Florida State University, one vocational education

---

[1]The follow-up questionnaire in Kaufman, et al., "A Cost-Effectiveness Study of Vocational Education," pp. 239-46, was consulted for development of the questionnaire for this study. A few items from that questionnaire were adapted verbatim, while some others were modified for the purposes of this study.

instructor, five former vocational education students, five high school graduates, and three high school dropouts. As a result of their feedback, certain changes were made in the questionnaire.

Names and last known addresses of all graduates and early leavers of the selected vocational education programs from August, 1968 through September, 1971, were provided by administrators at each of the selected area vocational centers. A random sample was made of the names and addresses provided and questionnaires, attached to the cover letter appearing in Appendix B, were mailed on December 27, 1971. Four weeks were allowed for return of questionnaires.

Table 1 shows, according to vocational program attended, the number of questionnaires mailed, the number returned, the number discarded because of (1) incomplete information, and/or (2) attendance at a community college, four-year college or university; the number of questionnaires discarded because respondents had no training related jobs; the number of usable questionnaires from respondents enrolled in secondary school; usable questionnaires from nonsecondary students; and total usable questionnaires.[1]

The electronics program had twenty-two returns which could have been used in the study. Representing less than

---

[1]Persons who attended college after vocational training were excluded from the study since the effects of vocational education could not have been isolated from the effects of college attendance. Persons who did not have any training related jobs were excluded since employment effects were probably not causally related to their vocational education.

TABLE 1

RETURN OF QUESTIONNAIRES BY PROGRAMS

	Mailed	Returned	Incomplete Data or Attended College	No Training Related Job	Usable Secondary	Usable Nonsecondary	Total Usable
Auto Mechanics	190	85	23	19	37	25	62
Air Conditioning & Refrigeration	150	72	26	22	16	30	46
Practical Nursing	200	113	14	5	9	90	99
Cosmetology	280	140	39	29	45	56	101
Electronics	238	37	15	12	6	18	22

10 per cent of the questionnaires mailed out, the electronics program was excluded from the study.[1]

Overview of Benefit-Cost Methodology

Like alternative objects of public or private spending, vocational education programs involve both benefits (advantages) and costs (disadvantages). In order to evaluate such programs (or any program) it is important to take into account the costs of producing benefits. The essence of explicitly linking costs to benefits as an overall evaluation design arises because it is conceivable to attain any objective if unlimited funds are available. However, limited funds or a scarcity of resources, a basic economic concept, are always a constraint.

There are two major classifications of benefits which are of concern when determining benefits. These are: (1) public benefits which accrue to society as a result of providing vocational education programs, and (2) private benefits which accrue directly to individual students who have taken vocational education.

Like benefits, there are two major classifications of costs which are of concern when calculating costs. These are: (1) the public costs incurred by society as a result of

---

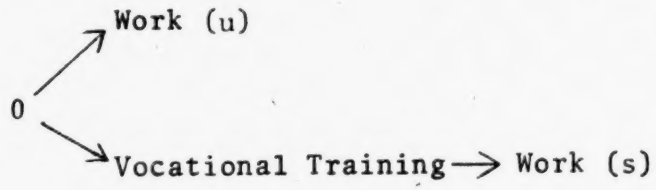
[1]One possible reason for the low return rate from electronics students may have been due to adverse economic and labor conditions in the electronics industry during the time of this study, thus forcing these people to geographically migrate.

offering given vocational programs, and (2) the private costs incurred by students taking vocational education.

Separating the benefit-cost methodology into public and private components emphasizes the need to investigate the benefits and costs of vocational education programs associated with the two primary investors and benefactors, namely, society at large (public benefits and costs), and individual students (private benefits and costs). Table 2 displays an overview of the benefit-cost methodology used in this study.

Methodology for Determining Program Benefits

Assuming a person wants to enter the labor market, the options available to him are as follows:



In this study it was assumed that persons who took vocational training before going to work entered the work force as skilled workers (s), and therefore had different wage rates and unemployment rates than unskilled workers (u).

Benefits resulting from vocational education programs used in this study were measures of the extent to which the employment objectives of vocational education programs were achieved. Thus, post-vocational education labor market experiences of former students were examined. Two measures of

TABLE 2

OVERVIEW OF BENEFIT-COST METHODOLOGY

Public	Private
Benefits	**Benefits**
Definition: Economic welfare gained by society as a result of vocational training.	Definition: Economic welfare gained by the student as a result of vocational training.
Elements	**Elements**
1. Student's marginal before tax wage rates attributable to vocational training.	1. Student's marginal after tax wage rates attributable to vocational training.
2. Reduced unemployment rates attributable to vocational training.	2. Reduced unemployment rates attributable to vocational training.
Costs	**Costs**
Definition: Costs incurred either directly or indirectly by the public sector (federal, state, and local governmental agencies) to support formal vocational training.	Definition: Costs incurred either directly or indirectly by students for formal vocational training.
Elements	**Elements**
1. Operating and capital funds expended to support a vocational program.	1. Direct expenses incurred by students due to attending school (e.g., tuition, books, supplies, etc.).
2. Opportunity costs of not expending funds on alternative public programs.	2. Foregone earnings or opportunity costs (indirect expenses) incurred by students as a result of attending school rather than being gainfully employed.

post-vocational education labor market performance were utilized: (1) measurement of wage rates, and (2) measurement of unemployment rates.

The wage rate was an average wage rate weighted according to the amount of time a person worked on jobs either related or very related to his vocational education program.[1] The formula for calculating weighted average wage rates follows:

$$(1) \quad W_i = \left(\frac{\Sigma_v L \frac{S}{H}}{\Sigma L_v} \right)_i$$

where:

W = weighted average wage rate;

i = individual student;

v = job either "related" or "very related" to vocational education program; v = 1,2;

L = length of time on job (in months);

S = midpoint of weekly salary;

H = number of hours worked per week.

Unemployment rates were converted to employment rates which were calculated as follows:

$$(2) \quad R_i = 1 - \left(\frac{I}{T - M} \right)_i$$

---

[1] As previously noted, persons without any training related jobs were excluded from the study entirely. Similarly, when persons had several jobs, some related and some unrelated to vocational training, unrelated jobs were excluded from the calculation of wage rates.

where:

R = employment rate;

i = individual student;

I = involuntary unemployment (in months);

T = time from completion of vocational education program (in months);

M = time in military service (in months).

Following national income accounting procedures, the employment rate (R) in algorithm (2) above was based only on involuntary unemployment. Voluntary employment did not enter into the calculation of the employment rate. Thus, productive activities apart from the market sector, such as production in the household sector, were not measured in the benefits of vocational education. Kaufman asserts the following regarding not counting involuntary unemployment as an economic output.

> The bias due to the national income account measure of benefits . . . which excludes household production from being included in gross national product should not lead one to conclude that household production is trivial in its impact on the economy or that efficiency in household production is not just as necessary as efficiency in market production.[1]

Wage rates and employment rates were combined into a net wage rate which served as a monetary index of labor

---

[1]Kaufman, et al., "A Cost-Effectiveness Study of Vocational Education," p. 150.

market performance of skilled workers as follows:[1]

$$(3) \quad E_{s,i} = (W_{s,i})\ (R_{s,i})$$

where:

E = net wage rate;

s = skilled worker;

i = individual student;

W = weighted average wage rate;

R = employment rate.

Since this study was concerned with differences in wage rates and unemployment rates between persons who enter the labor market as unskilled workers and those who enter the labor market as skilled workers, after-training wage rates and employment rates [$(E_{s,i})$ in algorithm (3)], had to be reduced by factors that represented wage rates and employment rates for unskilled workers in Florida.

Wage rates for unskilled workers vary according to the region in Florida where a person works. Regional differences in wage rates were explicitly incorporated into the calculation of a monetary index for unskilled workers in

---

[1] While wage rates and unemployment rates reflect an important part of the monetary benefits of vocational education, there are certain qualifications which should be recognized. First, wage rates and employment rates may not necessarily indicate the increased productivity of workers. Second, labor supply and demand conditions for particular labor skills affect wage rates and employment rates. Thus, changes in wage rates and employment rates may not be due only to vocational education programs.

Florida.[1] Additionally, employment rates for unskilled workers were imputed into the monetary index.[2] The algorithm for calculating the net wage rate which served as a monetary index for unskilled workers in Florida follows:

$$(4) \quad E_{u,j} = (W_{u,j}) \ (R)$$

where:

E = net wage rate;

u = unskilled workers;

j = region of Florida; r = 1, ..., 4;

W = wage rate;

R = employment rate (100% minus unemployment rate).

The differences between the net wage rates for skilled workers and the net wage rates for unskilled workers represented the net benefits resulting from vocational education programs. When these net benefits were converted to an annual earnings figure, this figure represented the annual benefits of vocational education programs.[3]

The algorithm for calculating the annual benefits of vocational education follows:

---

[1]The average of the midpoints of wage rates for each region was used (see Appendix C).

[2]The unemployment rate figure used was 7.1 per cent, the average unemployment rate for "operatives" in Florida for 1968-1971. Source: U.S. Department of Labor, Manpower Report of the President (Washington, D.C.: Government Printing Office, 1972), p. 216.

[3]The net marginal wage rate was converted to an annaul earnings figure by multiplying it by 2080 hours, the normal number of work hours per year.

$$(5) \quad B_i = [(E_{s,i}) - (E_{u,j})] \; K$$

where:

B = annual benefits;

i = individual student;

E = net wage rate;

s = skilled worker;

u = unskilled worker;

j = region; j = 1, ..., 4;

K = 2080 hours.

Public benefits of vocational education

This study followed national income accounting procedures for measurement of public benefits. That is, the annual benefits before federal income tax deductions [(B_i) in algorithm (5) above] were considered as the public benefits of vocational education programs, since these earnings represented an increase in national income.

Private benefits of vocational education

National income accounting procedures also were used for the measurement of private benefits. Annual benefits after deduction of federal income taxes were considered as private or individual student benefits since these earnings represented an increase in personal disposable income.

The algorithm for calculating the annual private benefits of vocational education follows:

$$(6) \quad PB_i = [(E_{s,i})\ (K)] - (T_{s,1})_i - [(E_{u,j})\ (K)] - T_u$$

where:

PB = private benefits;

i = individual student;

E = net wage rate;

s = skilled worker;

K = 2080 hours;

T = federal income tax on earnings;[1]

1 = year;

u = unskilled worker;

j = region of Florida; j = 1, ..., 4.

Relatedness index

Since the relationship of after training employment to vocational education programs did not enter into the calculation of monetary benefits, except to the extent that jobs completely unrelated to training were excluded from the calculation of benefits, a third measure of benefits of vocational education was developed.

Since those persons who found employment which was "most" related to their vocational trainings probably realized benefits in addition to economic benefits,[2] the

---

[1]Federal income tax was based on the number of dependents reported by each person. Tax on earnings for unskilled workers was based on the same number of dependents as for skilled workers.

[2]Examples of such additional benefits would include psychic effects of utilizing training and effects of achieving a goal.

relatedness index which was developed measured the relationship between vocational education program and subsequent jobs. Weighted according to the time on a given job, a value of "1" was assigned to jobs "related" to vocational training and a value of "2" assigned to jobs "very related" to vocational training. Thus, the closer the index was to "2" the more related employment was to the vocational education programs, and the higher the additional benefits.

The algorithm for deriving the relatedness index follows:

$$(7) \quad RI_i = \frac{\Sigma_{rm} L_m}{\Sigma L_m}$$

where:

RI = relatedness index;

i = individual student;

r = relatedness value for job m; r = 1,2;

m = "related" or "very related" job;

L = length of time on job m (in months).

Methodology for Determining Program Costs

Public costs of vocational education

Current operating and capital costs incurred either directly or indirectly (opportunity costs) by the public sector (federal, state, and local governmental agencies) comprised the public costs of vocational education programs. In order to calculate the public cost of vocational education for a given student, two factors must be considered: (1) the

quantity of time that a student spends in a given vocational education program, and (2) the value or cost per unit of time of the services he received as measured in terms of dollars.

The quantity of time students spent in a vocational education program was measured in terms of hours of attendance which were obtained from the follow-up questionnaires. Value of services or unit costs were based upon vocational education costs which were generated by a study conducted for the Florida Division of Vocational, Technical and Adult Education.[1] This study included an analysis of the following expenditures of area vocational/technical centers:

1. An amount allocated from expenditures for system-wide administration.
2. An amount allocated from the expenditures made for the county-wide administration and supervision of vocational, technical and adult education.
3. An amount determined to have been expended for current operations for instruction in the vocational/technical programs provided in the center, including:
   a. salaries for certified personnel,
   b. salaries for non-certified personnel,
   c. free textbooks,
   d. library services,
   e. instructional supplies,
   f. other expenses for instructors, and
   g. contracted services for instruction.
4. An amount determined to have been expended for the operation of the physical plant of the Area Center (or an amount allocated from district-wide expenditures for plant operations).
5. An amount determined to have been expended for the maintenance of the physical plant of the Area Center (or an amount allocated from district-wide expenditures for plant maintenance).
6. An amount determined to have been expended for auxiliary services, including transportation.

---

[1] Associated Consultants in Education, Inc., Current Operating Costs, 1970-71, Florida Area Vocational/Technical Centers (Tallahassee: Author, 1972).

7. An amount allocated from district-wide fixed charge expenditures.
8. Charges for depreciation of movable equipment calculated at one tenth of the original value of the equipment.
9. An amount expended for current operations of the Center from its internal accounts (from non-tax soucres).[1]

The objective in analyzing these expenditures was to provide a statement "in dollar terms of the cost of providing instruction for one student contact hour in each of the vocational/technical courses given during the year . . . "[2] In order to obtain the dollar cost per full-time-equivalent (FTE)[3] for each course, "the total cost per hour of student attendance is (was) multiplied by 810."[4] The costs per FTE by program and region which were used in this study appear in Appendix D.

The algorithm for calculating the public costs of vocational education for each student was as follows:

$$(8) \quad C^{p}_{i,z,j,1} = \left[(F)_{z,j,1} \left(\frac{N_{i,z}}{810} \right) \right] 1.06$$

where:

C = cost;

p = public;

i = individual student

---

[1] Ibid., p. 23. [2] Ibid., p. 1.

[3] One full-time-equivalent equals 810 student hours of attendance.

[4] Associated Consultants in Education, Current Operating Costs, p. 15.

ε = programs;

j = region; j = 1, ..., 4;

1 = year; 1 = 1968-69, 1969-70, 1970-71;

F = public cost per full-time-equivalent (FTE) student;

N = number of hours of vocational training;

.06 = social opportunity cost.[1]

Private costs of vocational education

The most important element of private costs of vocational education are indirect costs incurred by students. These are the opportunity costs of foregone benefits which students could have realized if they had been employed in the labor market rather than attending vocational training. Schultz has estimated that indirect cost of this nature represents about 60 per cent of the total cost of education and is greater than the contribution from tax sources (public costs).[2]

Private indirect costs are a function of two factors:

---

[1]Costs can be viewed as opportunity costs since they represent the foregone benefits of alternative opportunities which cannot be pursued due to following a given activity. Therefore, assessment of costs of vocational education programs should impute foregone benefits. The public opportunity cost of the foregone benefits on alternative social investments was assumed to be 6 per cent. For an exposition of the theoretical rationale for public opportunity costs see Otto Eckstein, "A Survey of the Theory of Public Expenditure Criteria," in Public Finance: Needs, Services and Utilization: A Conference of the Universities (Princeton, New Jersey: Princeton University Press, 1961).

[2]Theodore W. Schultz, The Economic Value of Education (New York: Columbia University Press, 1963), p. 25.

(1) the quantity of time that a student spends in a given vocational education program, and (2) the value or price of time as measured by earnings foregone.

As stated previously, the quantity of time one spends in a vocational education program in Florida is measured in terms of student hours of attendance. Value or price of time was based upon prevailing wage rates for unskilled workers in the geographic region where a student took his vocational training. These values were the same as those used when wage rates were calculated except here they were adjusted by the amount of the implicit price deflator used in the calculation of real GNP according to the year in which a person took his vocational training.

A second element of private costs of vocational education are the direct costs incurred by the student. These are the costs paid by the student for tuition, books, supplies, uniforms, special equipment, and transportation.[1] Appearing in Appendix E are the private direct costs which, when adjusted for time of attendance in the vocational education program, were the data used in the study.

The algorithm for calculating the total private costs of vocational education for each student was as follows:

$$(9) \quad PC_{i,z,j,l} = (W_{u,j})\, N_{i,z} + D_{i,z,j,l}$$

---

[1] It was assumed that private direct costs of transportation to training centers were the same as if the student were working. Therefore, transportation costs were not relevant.

where:

PC = cost;

i = individual student;

z = programs;

j = regions; j = 1, ..., 4;

1 = year; 1 = 1968, 1969, 1970, 1971;

W_u = adjusted wage rate of unskilled worker;

N = number of hours of attendance in program;

D = direct costs for tuition, books, supplies, equipment, and uniforms.

Methodology for Determining Benefit-Cost Ratios

Although benefit and cost methodologies were discussed separately in the previous sections, no conclusions as to the economic efficiency of the four vocational education programs can be made until the relationship of benefits to costs is considered. The explicit linking of benefits to costs is achieved by means of the benefit-cost ratio which is a measure of economic efficiency.

The choice of the benefit-cost ratio as the proper investment criterion for linking benefits to costs is summarized by Kaufman as follows:

> . . . when there is capital rationing (and this is probably a common situation for an individual contemplating investment in himself), the benefit-cost ratio is the proper criterion for investment decision-making, since by choosing the set of investments with the highest ratios he thereby maximizes net present value.[1]

---

[1]Kaufman, et al., A Cost-Effectiveness Study of Vocational Education," p. 59.

Benefits in the form of earnings are realized over many years of post-vocational education employment, while costs, including opportunity costs, are incurred in the period of the vocational education program (normally one year or less). Since money has a time value, money (benefits) which is realized in future years must be discounted to the present value of that money.[1] Discounting is effected using an appropriate interest rate. Since no theoretically correct interest rate exists, it is useful to select one near the top of the range suggested by theoretical considerations, thereby making the benefit-cost ratio a conservative index. Weisbrod has suggested a discount rate of 10 per cent for this purpose and this rate was used in this study.[2]

It was assumed that costs (both public and private) were incurred in a present value time period. Therefore, no discounting of costs was needed.

When discounted benefits are linked to present value costs in the form of a benefit-cost ratio, the resultant figure is useful for comparison of a program's economic efficiency over previous years, limited to monetary aspects,

---

[1]Discounting is a term which refers to finding the present value of money received in the future. For example, $100 earned five years from now is worth considerably less than $100 earned today. At a 10 per cent discount rate $100 five years from now has a present value of $62. Conversely, $62 invested today at 10 per cent simple interest will be worth $100 five years from today.

[2]Burton A. Weisbrod, "Conceptual Issues in Evaluating Training Programs," Monthly Labor Review, LXXXIX (October, 1966), 1099.

with other programs. This ratio number is also the percentage rate of return per year on investment in vocational education programs. The reciprocal of this ratio number is equivalent to the number of years it will take a person (or society) to receive a "total return" on his (its) investment.

The formula for calculating public and private benefit-cost ratios is as follows:

$$B_0 / C_0 = \frac{\frac{b_0}{(1+i)^0} + \frac{b_1}{(1+i)^1} + \cdots \frac{b_t}{(1+i)^t}}{\frac{C_0}{(1+i)^0}}$$

where:

B/C = benefit-cost ratio;

b = benefits;

t = time period; t = 0; . ., 2;

c = costs;

i = discount rate of interest; i = 10%.

Statistical Techniques Employed

Three primary statistical techniques were employed in this study--analysis of variance, chi square, and multiple regression analysis.

Analysis of variance was used to make comparisons of quantitative data between programs while chi square was used to compare qualitative data.

Multiple regression analysis was employed in order to assess the effects of student socio-demographic characteristics on benefits and costs. This was done because t

benefits accruing to vocational education students are not evenly distributed among all students.[1]

Furthermore, the determination of a pattern of maximizing efficiency is dependent upon the distribution of benefits and costs, since the magnitude of the benefits and costs of vocational education is, to a certain extent, specific to the socio-demographic characteristics of students. Therefore, efficiency evaluation of vocational education programs is a function of not only the type of vocational education program, but also the labor market conditions into which trained persons enter and the personal characteristics of the recipient of vocational education.

Additionally, multiple regression analysis yields formulae useful for planning purposes. Benefit-cost indicators of vocational education programs for students with specific characteristics can be predicted using formulae generated by multiple regression analysis.

---

[1]Walter Fogel, "The Effect of Low Educational Attainment on Incomes: A Comparative Study of Selected Ethnic Groups," The Journal of Human Resources, I (Fall, 1966), 23.

CHAPTER III

PRESENTATION AND ANALYSIS OF DATA

In Chapter II, the methodology for deriving benefits, costs, and benefit-cost ratios was presented. This chapter describes the sample data and presents a comparison and analysis of persons who attended each of the four vocational education programs in terms of (1) benefits, (2) costs, (3) relationship of employment to vocational education program (relatedness index), and (4) benefit-cost ratios.

Description of Sample

Of the total respondents the average respondent was 26.7 years old, white (88% of sample), married (55% of sample), if he had children (45% of the sample had children) he had 2.4 children, completed high school (92% of sample), had a high school grade point average of 2.53,[1] and on the average he attended vocational education for 1173 hours. After completing vocational education the average respondent did not serve in the military for three months or longer (4% did serve in the military).

During the majority of his elementary and secondary school years his father lived with his family (80% of sample);

---

[1] Grade point average was measured on a 4.0 scale.

his father finished 10.6 years of school[1] and earned $6640 per year.[2] His mother completed 10.8 years of sch ol.

Fifty-one per cent of the total respondents were employed either part time or full time while attending vocational training, although a majority of the total respondents (57%) did not have related working experience prior to completing their vocational training. Only 12 per cent of the total respondents took additional related training after completing their vocational education programs. Secondary students who attended vocational education comprised 35 per cent of the total respondents (65% were nonsecondary students).

Of the total 308 respondents 33 per cent attended the nursing program, 32 per cent attended the cosmetology program, 20 per cent attended the auto mechanics program, and 15 per cent attended the air conditioning program. All the respondents from the auto mechanics program and air conditioning program were males (35% of the total), while all the respondents from the nursing and cosmetology programs were females (65% of the total). By geographic regions 34 per cent of the respondents were from southeast Florida, 25 per

---

[1]Fathers who did not live with the respondents' families during the majority of the respondents' elementary and secondary school years are not included in the average fathers' education figures. As such, 19 per cent of the total respondents were excluded from the average father's education figure.

[2]Respondents' fathers who were either retired or deceased were not included in the father's income figure. As such, 33 per cent of the total respondents were excluded from the father's income figure.

cent were from central Florida, 24 per cent were from southwest Florida, and 16 per cent were from north Florida.

An analysis of the total respondents in terms of the dependent variables of public and private benefits, public and private costs, public and private benefit-cost ratios, and relatedness index appears in Table 3.[1] This table shows the relationship between measures of the dependent variables and selected independent variables.

The data in Table 3 indicates a profile of characteristics of persons who had the highest returns on investment in vocational education as measured by benefit-cost ratios. On the average, these persons: attended vocational education for less than 600 hours; had related working experience prior to entering the labor market; were employed during training; took additional training after entering the labor market; and were married white persons over thirty years old who finished four years of high school with a grade point average above 2.60.[2]

In addition to economic returns, Table 3 also indicates a profile of characteristics of persons whose jobs were most related to their vocational education program as measured by the relatedness index. On the average, these persons: attended vocational education for 1051 hours; were not

---

[1]These data show gross relationships. After controlling for the influence of other socio-demographic variables and specific program effects, the net relations for these variables may change.

[2]Grade point average was measured on a 4.0 scale.

TABLE 3

BENEFITS, COSTS, BENEFIT-COST RATIOS, AND RELATEDNESS INDEX AS A FUNCTION OF SELECTED SOCIO-DEMOGRAPHIC VARIABLES FOR TOTAL SAMPLE IN ALL PROGRAMS

	Dependent Variables						
Independent Variables	Public Benefit	Private Benefit	Public Cost	Private Cost	Public Benefit-Cost Ratio	Private Benefit-Cost Ratio	Relatedness Index
Hours of Attendance							
Up to 600 (N=27)	$ 957	$ 791	$ 571	$ 866	2.38	1.38	1.47
601-1050 (N=23)	2161	1809	1212	1913	1.66	.89	1.70
1051 or Above (N=258)	1050	885	1881	2617	.51	.31	1.88
Related Working Experience							
Yes (N=134)	1283	1071	1687	2381	.84	.49	1.82
No (N=174)	1004	850	1738	2433	.72	.41	1.84
Employed During Training							
Yes (N=149)	1263	1062	1609	2200	1.04	.62	1.79
No (N=158)	991	833	1814	2610	.50	.29	1.87
Additional Training							
Yes (N=47)	1651	1389	1745	2379	1.39	.81	1.73
No (N=261)	1031	866	1711	2416	.65	.39	1.85
Marital Status							
Single (N=113)	854	703	1489	2221	.63	.34	1.74
Married (N=169)	1287	1090	1834	2512	.90	.54	1.92
Separated, Widowed or Divorced (N=26)	1255	1063	1938	2539	.49	.33	1.88
Race							
White (N=272)	1156	971	1709	2407	.79	.46	1.85
Nonwhite (N=36)	891	753	1769	2437	.60	.38	1.69
Age							
Up to 20 (N=102)	787	651	1468	2223	.50	.27	1.77
21-25 (N=104)	908	752	1905	2508	.55	.33	1.87
26-30 (N=22)	1448	1206	1751	2419	.60	.41	1.85
30 or Above (N=80)	1751	1501	1778	2521	1.42	.84	1.86
High School Level Completed							
1-3 Years (N=26)	378	1064	1592	2195	-.03	.02	1.75
4 Years (N=282)	1194	1202	1728	2430	.84	.4	1.84
High School Grade Pt. Ave.							
Up to 2.30 (N=118)	800	669	1661	2308	.66	.4	1.80
2.31 - 2.59 (N=74)	1183	993	1732	2418	.71	.44	1.81
2.60 or Above (N=116)	1419	1198	1762	2510	.91	.51	1.88
Mean of the Dependent Variable	$1125	$ 946	$2215	$2411	.45	.76	1.83

employed during training; did not take additional training after entering the labor market; and were married white persons over twenty-one years old who finished four years of high school with a grade point average above 2.60.

Before analyzing monetary benefits, relatedness index, costs, and benefit-cost ratios between vocational education programs, it is in order to look at differences and similarities in student socio-demographic variables between each of the four programs.

Between programs there were significant differences in some student characteristics.[1] On the average, the ages of respondents who attended the nursing program (33.3 years) and the air conditioning program (29.4 years) was significantly ($p < .001$)[2] higher than the average ages of respondents who attended either the cosmetology program (22.4 years) or the auto mechanics program (21.1 years) The only significant difference in race composition between programs was in the nursing program. The percentage of nonwhite respondents who attended the nursing program (18.2%) was significantly ($p < .10$) higher than for either the auto mechanics program (11.3%), the air conditioning program (8.7%) or the cosmetology program (6.9%). Mothers of respondents who attended the auto mechanics program had, on the average,

---

[1]Analysis of variance of quantitative variables appears in Appendix F and a chi square analysis of qualitative variables appears in Appendix G.

[2]All statistics were tested against four levels of significance: $p < .001$; $p < .01$; $p < .05$; and $p < .10$.

significantly ($p < .01$) more education (11.8 years) than did mothers of respondents who attended the nursing program (10.2 years).

The percentage of secondary students who attended the auto mechanics program (60.7%) was significantly ($p < .001$) higher than either the percentage of secondary students who attended the air conditioning program (34.8%), the nursing program (9.1%), or the cosmetology program (44.6%).

Some student characteristics did not differ significantly between programs. There were no significant differences between programs in the average number of children respondents had, nor was there a significant difference in the number of years of high school completed. Likewise, there were no significant differences between programs in either father's annual income, father's education, or respondents' grade point average in high school. There were no significant differences in mother's education between respondents who attended either the air conditioning program (10.6 years), the nursing program (10.2 years), or the cosmetology program (10.8 years).

Comparison and Analysis of Benefits

There were two major classifications of benefits which were considered in this study: (1) public or social benefits, and (2) private or student benefits. A third measure of benefits--relatedness index--gauged the relationship of employment to vocational education program attended.

Presented in this section are comparisons

analyses of benefits between each of the four vocational education programs, and comparisons between secondary and nonsecondary students in all programs. Included are comparisons and analyses of (1) public benefits, (2) private benefits, (3) socio-demographic effects on benefits, and (4) relatedness index.

Public benefits

Calculation of public benefits per student was based on wage rates and employment rates (a monetary index) before deduction of federal income taxes.

The average public benefit per student for each program and for secondary and nonsecondary students in all programs appears in Table 4. Based upon the statistical technique of analysis of variance, comparisons and analyses of public benefits per student between programs and between secondary and nonsecondary students in all programs follow.[1]

The average public benefit for persons who attended the air conditioning program[2] ($2646) was significantly ($p < .001$) higher than for persons who attended either the nursing program ($1252), the auto mechanics program ($997), or the cosmetology program ($393). Contributing to the higher public benefit for the air conditioning program was a

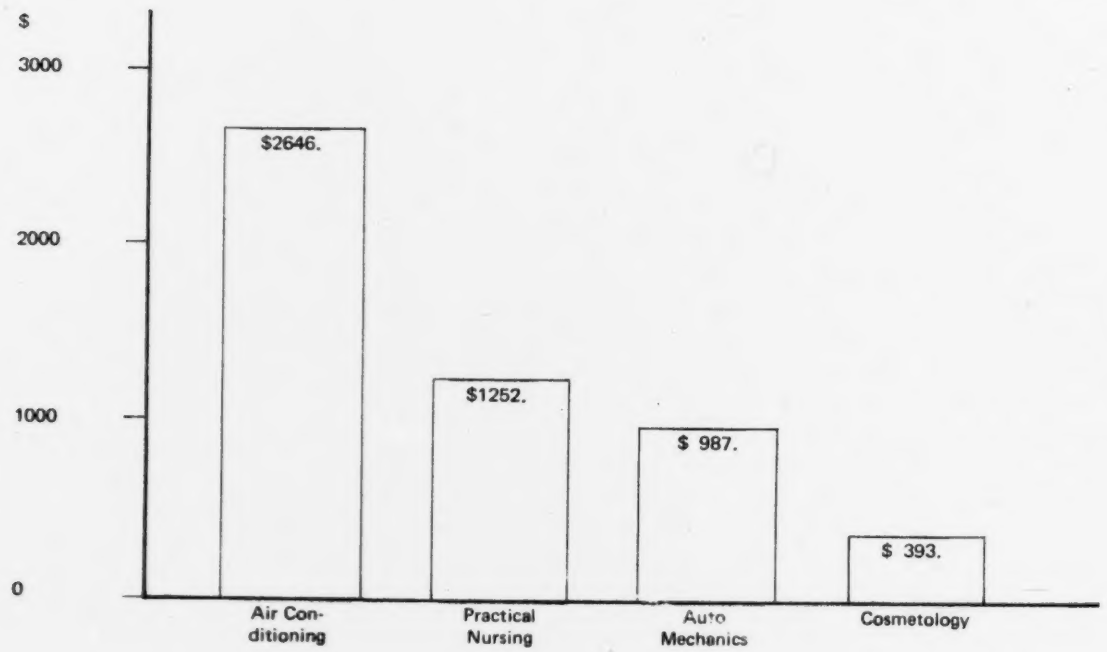
---

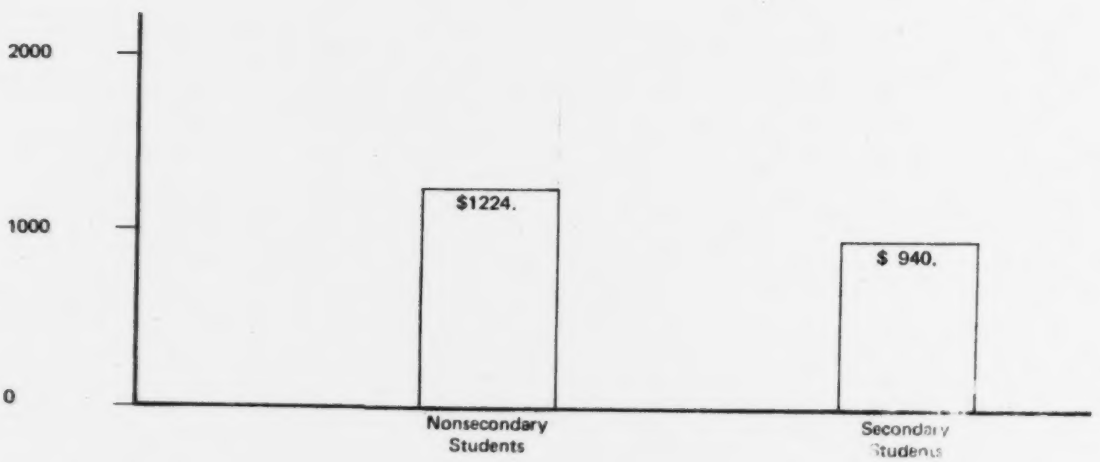
[1] See Appendixes F and H for analyses of variance.

[2] Neither institution selected in north Florida had an air conditioning and refrigeration program. Therefore, north Florida is not represented in the air conditioning program data.

TABLE 4

AVERAGE PUBLIC BENEFITS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)





comparatively low rate of involuntary unemployment (.17 months per year) experienced by persons who attended the air conditioning program as compared to the involuntary unemployment rates experienced by persons who attended either the nursing program (.87 months per year), the auto mechanics program (.58 months per year), or the cosmetology program (.26 months per year).

The average public benefit for the nursing program ($1252) was significantly ($p < .001$) higher than the average public benefit for the cosmetology program ($333). Since the average amount of involuntary unemployment for persons who attended the nursing program (.87 months per year) was significantly ($p < .10$) higher than for persons who attended the cosmetology program (.26 months per year), the difference in public benefits between the two programs was due largely to differences in wage rates rather than employment rates.

There was no significant difference in public benefits between persons who attended the nursing program ($1252) and persons who attended the auto mechanics program ($987), but the average public benefit for persons who attended the auto mechanics program ($987) was significantly ($p < .10$) higher than the average public benefit for persons who attended the cosmetology program ($333).

Over all programs, the average public benefit for secondary students ($940) was significantly ($p < .05$) lower

than the average public benefit for nonsecondary students ($1224).[1]

Private benefits

Calculation of private benefits per student was based on wage rates and employment rates (a monetary index) after deduction of federal income taxes.

The average private benefit per student for each program and for secondary and nonsecondary students in all programs appears in Table 5. Based upon the statistical technique of analysis of variance, comparisons and analyses of private benefits per student between programs and between secondary and nonsecondary students in all programs follow.[2]

The average private benefit for persons who attended the air conditioning program ($2230) was significantly ($p < .001$) higher than for persons who attended either the nursing program ($1056), the auto mechanics program ($816), or the cosmetology program ($333). Contributing to the higher private benefit for persons who attended the air conditioning program was the comparatively low rate of involuntary unemployment (.17 months per year) these persons experienced.

The average private benefit for persons who attended the nursing program ($1056) was significantly ($p < .001$)

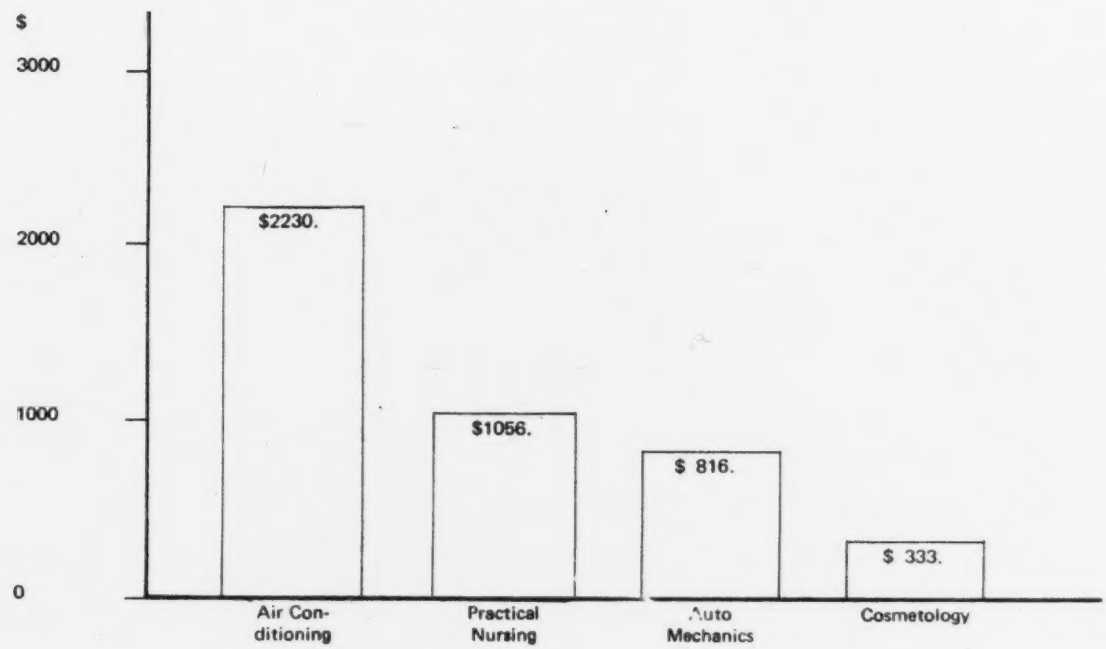
---

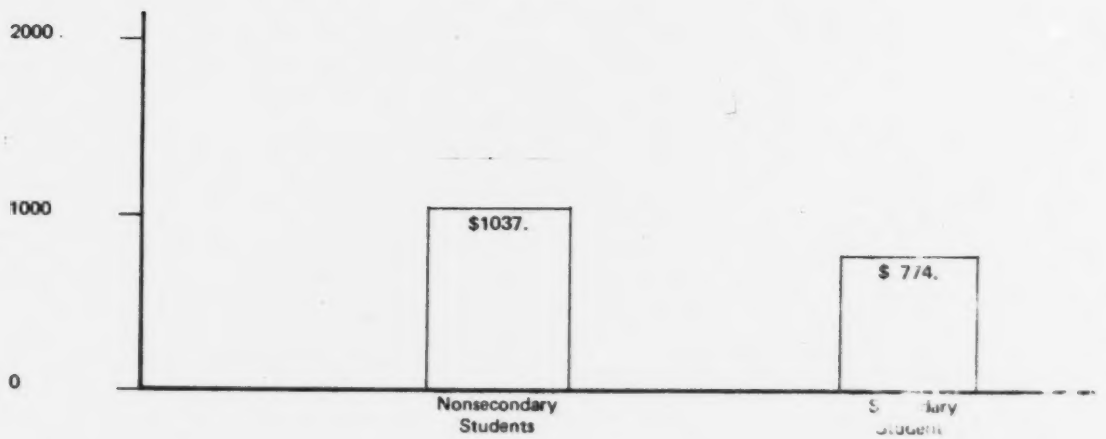
[1]There were significant differences in public benefits between programs for secondary and nonsecondary students. These differences are reported in Appendix H.

[2]See Appendixes F and H for analyses of variance.

TABLE 5

AVERAGE PRIVATE OR STUDENT BENEFITS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)





higher than the average private benefit for persons who attended the cosmetology program ($333). There was no significant difference between the average private benefits for persons who attended either the nursing program or the auto mechanics program ($816), nor was there a significant difference in the average private benefit between persons who attended the auto mechanics program or the cosmetology program ($333).

Over all programs the average private benefit for secondary students ($774) was significantly ($p < .05$) lower than the average private benefit for nonsecondary students ($1037).[1]

Socio-demographic effects on benefits

In order to analyze the effects of student socio-demographic characteristics on public and private benefits for each program, multiple regression analysis was employed. The multiple regression analyzed the relationship between student socio-demographic characteristics and (1) public benefits, and (2) private benefits. Since public benefits differed from private benefits only by the amount of federal income taxes, multiple regression analyses for public and private benefits were very similar. The complete regressions for both public and private benefits appear in Appendixes I

---

[1] There were differences in private benefits for secondary and nonsecondary students between programs and these differences are reported in Appendix H.

and J, respectively, while a summary table of the statistically significant socio-demographic variables for private benefits appears in Table 6. A discussion of summary Table 6 follows.

Even after controlling for regional differences in wage rates, the region of employment was significantly related to private benefits for persons who attended the air conditioning program and for persons who attended the nursing program. Persons who attended the air conditioning program and were employed in southwest Florida earned, on net (that is, holding the effects of all other variables constant), $980 (earnings are net of federal income taxes) less per year than if these persons had worked in southeast Florida. There were no significant differences in private benefits between the other regions for persons who attended the air conditioning program.

Similarly, persons who attended the nursing program and were employed in southwest Florida earned, on net, $807 less per year than if these persons had worked in southeast Florida. There were no significant differences in private benefits between the other regions for persons who attended the nursing program.

The relatedness index was significantly related to private benefits for persons who attended the air conditioning program. For a one point increase in the relatedness index (for example, from related jobs to very related jobs), persons who took the air conditioning program had, on net, a

TABLE 6

SUMMARY OF MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE BENEFITS FOR EACH PROGRAM

Socio-Demographic Variables	Programs			
	Auto Mechanics	Air Conditioning	Licensed Practical Nursing	Cosmetology
Region	NSR	SR[c]	SR[a]	NSR
Relatedness Index	NSR	SR[d]	NSR	SR[d]
Additional Related Training	NSR	NSR	NSR	SR[c]
Race	SR[a]	SR[b]	NSR	NSR
Secondary Student	NSR	NSR	NSR	SR[d]
Marital Status	NSR	NSR	NSR	SR[d]
Father's Annual Income	SR[b]	NSR	NSR	NSR
Hours of Attendance	SR[a]	NSR	SR[d]	NSR
Age	NSR	NSR	SR[c]	SR[a]
High School Grade Point Average	NSR	SR[a]	NSR	NSR

SR = Significantly Related

NSR = Not Significantly Related

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

$705 per year increase in their private benefits. Similarly, persons who took the cosmetology program had, on net, a $812 per year increase in their private benefits for a one point increase in their relatedness index. Thus, as employment for persons who attended these programs was more related to their vocational training, they not only enjoyed benefits beyond economic returns, but also had additional economic returns.

Persons who attended the cosmetology program and who had additional training related to cosmetology earned, on net, $341 less per year than similar persons who did not take additional training. Since this study examined a limited time in the labor force, it apparently did not capture the effects of additional training on private benefits. It is likely that reduced income in the short-run will be more than recouped in the long-run as a result of additional training.

Race was significantly related to private benefits for persons who attended the auto mechanics program and for persons who attended the air conditioning program. White persons who attended the auto mechanics program earned, on net, $1209 more per year than similar nonwhite persons. Likewise, white persons who attended the air conditioning program earned, on net, $2014 more per year than similar non-white persons.

Attending vocational education as a secondary student was significantly associated with private benefits in one program. Secondary student who attended the cosmetology

program earned, on net, $416 less per year than similar non-secondary students who attended the cosmetology program.

Marital status was significantly related to private benefits for persons who attended the cosmetology program. Married persons who attended the cosmetology program earned, on net, $416 more per year than did similar persons who were either separated, widowed, or divorced. There was no significant difference in private benefits between single persons and separated, widowed, or divorced persons in the cosmetology program.

Students' fathers' annual incomes were significantly related to private benefits for persons who attended the auto mechanics program and for persons who attended the cosmetology program. For persons who attended the auto mechanics program, higher categories of fathers' annual income ($8001-$9000 and $10,001 or above) were associated with higher private benefits ($657 and $1029 more per year, respectively) as compared to similar persons whose fathers' annual incomes were in the lowest category (up to $4000). Likewise, persons who attended the cosmetology program whose fathers' annual incomes were in the higher categories ($8001 - $9000 and $9001-$10,000) earned, on net, $773 and $541 more per year, respectively, than did similar persons whose fathers' annual incomes were in the lowest category (up to $4000).

Hours of attendance in the auto mechanics program and the nursing program were significantly related to private benefits. Persons who attended the auto mechanics program

realized an increase in their private benefits, on net, of $1.40 per year for each additional hour they attended the auto mechanics program. Similarly, persons who attended the nursing program realized an increase in their private benefits, on net, of $.60 per year for each additional hour they attended the nursing program.

Age was significantly related to private benefits for persons who attended the nursing program. Private benefits increased, on net, $18 per year for each one year increase in a person's age.

High school grade point average was significantly related to private benefits for persons who attended the air conditioning program. Two students with the same socio-demographic characteristics, except for a one point difference in high school grade point average, had a difference of $1448 per year in their private benefits, with higher private benefits going to the person with the higher grade point average.[1]

In sum, the multiple regression analysis showed that a student's socio-demographic characteristics significantly affected his private benefits.

Relatedness index

As an additional indicator of the benefits of

---

[1]Grade point average was measured on a 4.0 scale.

vocational education the relatedness index[1] measured the relationship between vocational education program attended and subsequent employment.

On the average, the relatedness index for the nursing program (1.92) was significantly greater than for either the auto mechanics program (1.60) or the air conditioning program (1.68). The relatedness index for the cosmetology program (1.95) was, on the average, also greater than either the auto mechanics program (1.60) or the air conditioning program (1.68). There was no significant difference in the index between the nursing program and the cosmetology program.[2]

While the monetary benefits for the cosmetology program were comparatively low, persons who attended cosmetology training had jobs which were more related to their training than did persons who attended either the auto mechanics program or the air conditioning program. Likewise, nursing students had lower monetary benefits than air conditioning students, but nursing students had jobs which were more related to their training than did air conditioning students.

Over all programs, on the average, the relatedness index for nonsecondary students (1.86) was significantly

---

[1]The range of the relatedness index is 1-2. The closer the index approaches 2, the more related were a person's jobs to his vocational education program.

[2]For an analysis of variance of the relatedness index between programs, see Appendix F.

($p < .01$) higher than the relatedness index for secondary students (1.77). This indicated that nonsecondary students, as compared to secondary, enjoyed benefits in addition to those measured by the monetary index.

Comparison and Analysis of Costs

There were two major classifications of costs which were considered in this study: (1) public or social costs, and (2) private or student costs.

Presented in this section are comparisons and analyses of costs between each of the four vocational education programs, and between secondary and nonsecondary students in all programs. Included are comparisons and analyses of (1) public costs, (2) private costs, and (3) socio-demographic effects on costs.

Public costs

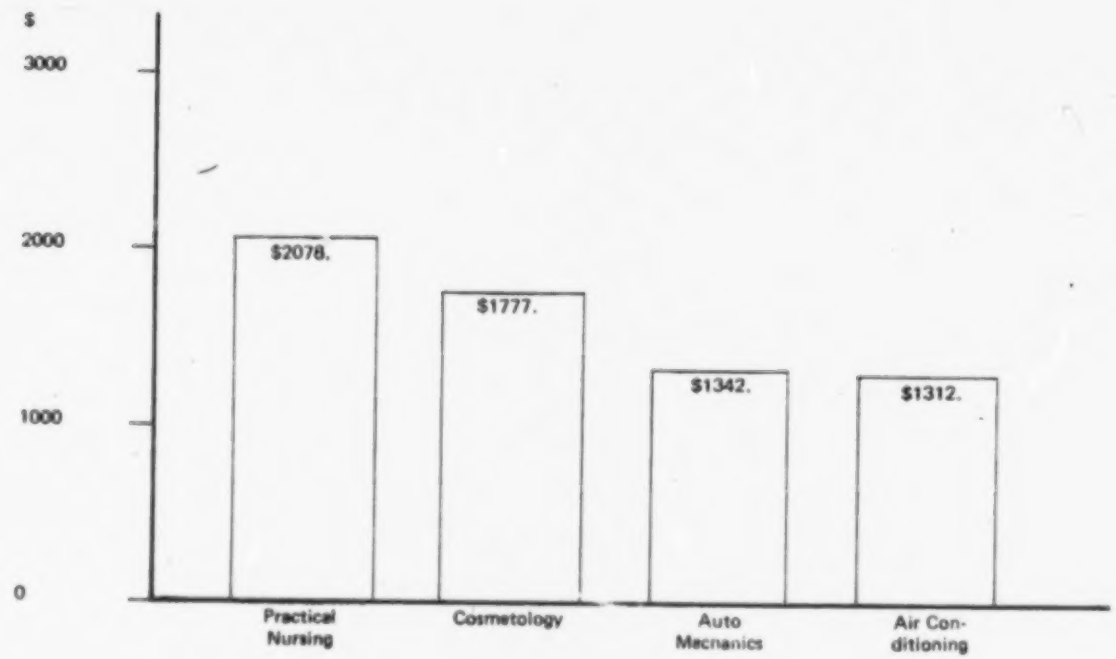
Calculation of public costs for each program was based on two factors: (1) the quantity of time that a student spent in a given program, and (2) the value of cost per unit of time for vocational education.

The average public cost per student for each program, and for secondary and nonsecondary students in all programs, appears in Table 7. Since public costs were a function of the quantity of time spent in a program, hours of attendance for each program and for secondary and nonsecondary students in all programs are portrayed in Table [illegible].

Based upon the statistical technique of anal[illegible] of

TABLE 7

AVERAGE PUBLIC COSTS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)



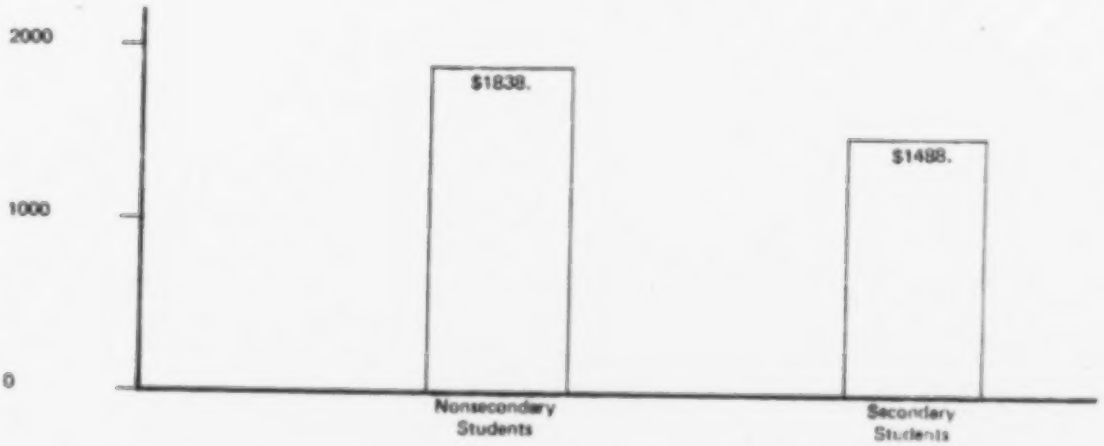
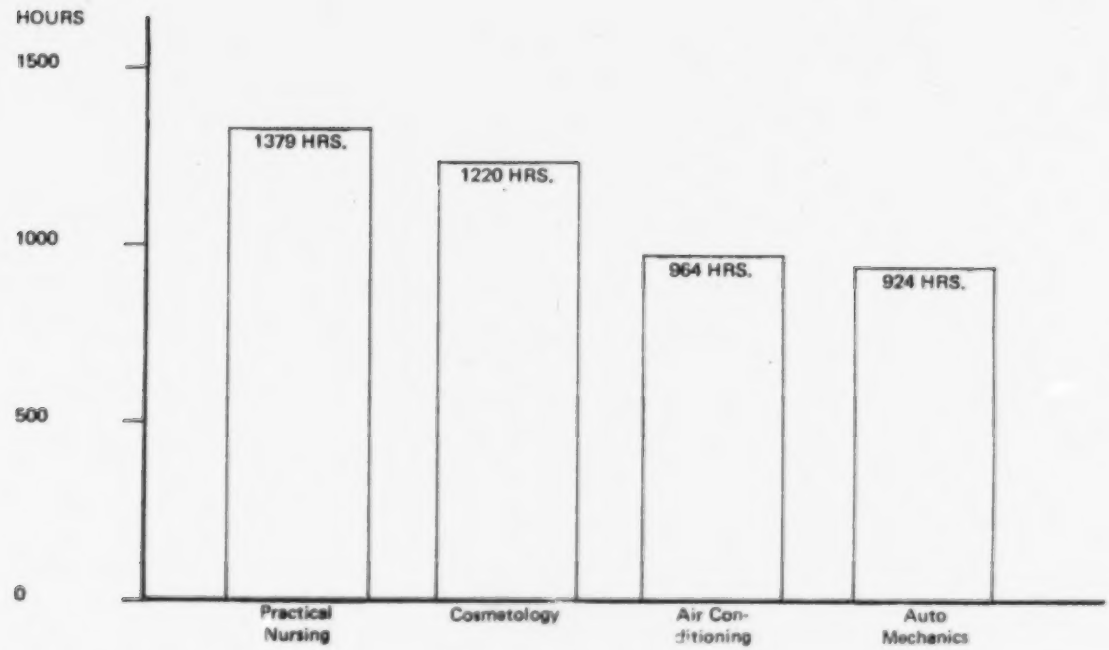
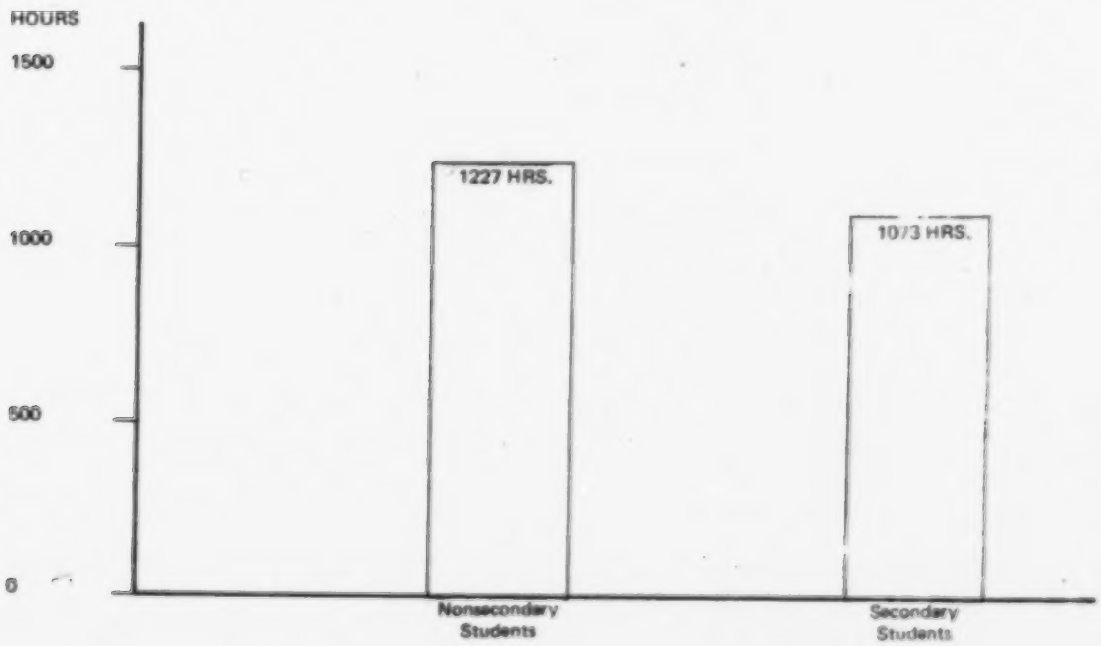


TABLE 8

AVERAGE NUMBER OF HOURS OF ATTENDANCE BY PROGRAM AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)





variance, comparisons and analyses of public costs per student and private costs per student between programs and between secondary and nonsecondary students in all programs follow.[1]

The average public cost for the nursing program ($2076) was significantly ($p < .001$) higher than for either the cosmetology program ($1777), the auto mechanics program ($1342), or the air conditioning program ($1312). Largely contributing to the higher public cost for the nursing program was the longer period of time students spent in the nursing program as compared to the other three programs. Average hours of attendance in the nursing program (1379) was significantly ($p < .001$) greater than for either the cosmetology program (1220), the air conditioning program (964), or the auto mechanics program (924). Another factor which contributed to the higher public cost for the nursing program was a higher unit cost ($1296 per FTE in 1970-71) as compared to the unit costs for the auto mechanics program ($1064 per FTE in 1970-71), and the cosmetology program ($1261 per FTE in 1970-71).[2]

The average public cost for the cosmetology program ($1777) was significantly ($p < .001$) higher than the average public cost for the auto mechanics program ($1342) and for

---

[1] See Appendixes F and H for analyses of variance of public costs between programs and between secondary and nonsecondary students in all programs, respectively.

[2] Appendix D presents the public unit costs (cost per FTE) for each program.

the air conditioning program ($1312). Largely contributing to the higher public cost for the cosmetology program (as compared to auto mechanics and air conditioning) was the greater length of time students spent in the cosmetology program.[1] Hours of attendance in the cosmetology program (1220) was significantly ($p < .001$) greater than in either the auto mechanics program (924) or in the air conditioning program (964). Another factor which contributed to the higher public costs for the cosmetology program was the higher unit cost ($1261 per FTE in 1970-71) for cosmetology as compared to the unit costs for the auto mechanics program ($1144 per FTE in 1970-71), and the air conditioning program ($1064 per FTE in 1970-71).

There was no significant difference in the average public cost between the auto mechanics program ($1342) and the air conditioning program ($1312). The insignificant differences in the number of hours of attendance between the auto mechanics program (924) and the air conditioning program (964) contributed to these similarities.

Over all programs the average public cost for secondary students ($1488) was significantly ($p < .001$) lower than the average public cost for nonsecondary students ($1838). Largely contributing to the lower public cost for secondary students was a significantly ($p < .001$) lower number of hours

---

[2]One factor contributing to the higher average number of hours of attendance in the nursing and cosmetology programs is that a minimum of 1200 hours of attendance in these programs is required in order to take the state licensing examinations.

of attendance in vocational education programs by secondary students (1073 hours) as compared to nonsecondary students (1227 hours).[1]

Private costs

Like the calculation of public costs, the calculation of private costs was based on two factors: (1) the quantity of time that a student spent in a given program, and (2) the value or cost per unit of that time. For private costs there were two factors included in the cost of a unit of time. The major factor was the opportunity cost of foregone earnings, while a comparatively minor factor was the direct costs incurred by students for tuition, books, supplies, uniforms, and special equipment. Since these latter costs only slightly affected total private costs, reference only is made to Appendix E where these costs for each program are reported.

The average private cost per student for each program and for secondary and nonsecondary students in all programs appears in Table 9. Like public costs, private costs were also a function of the number of hours a student attended a vocational education program. Therefore, hours of attendance reported here are the same as those portrayed in Table 8 and discussed under public costs.

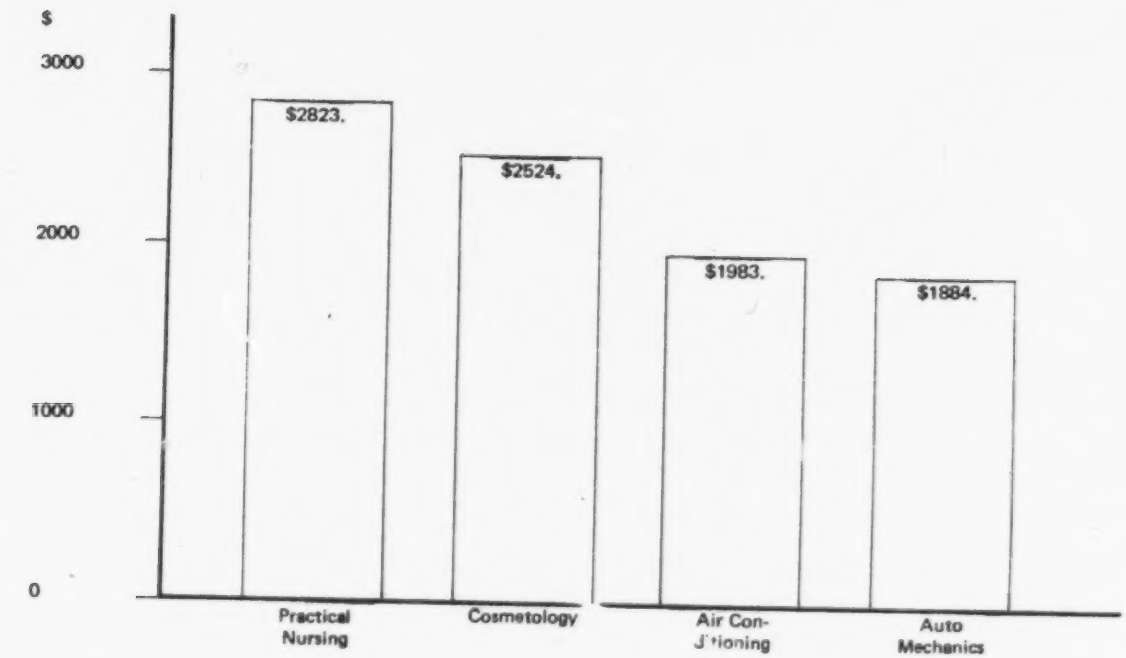
Based upon the statistical technique of analysis of

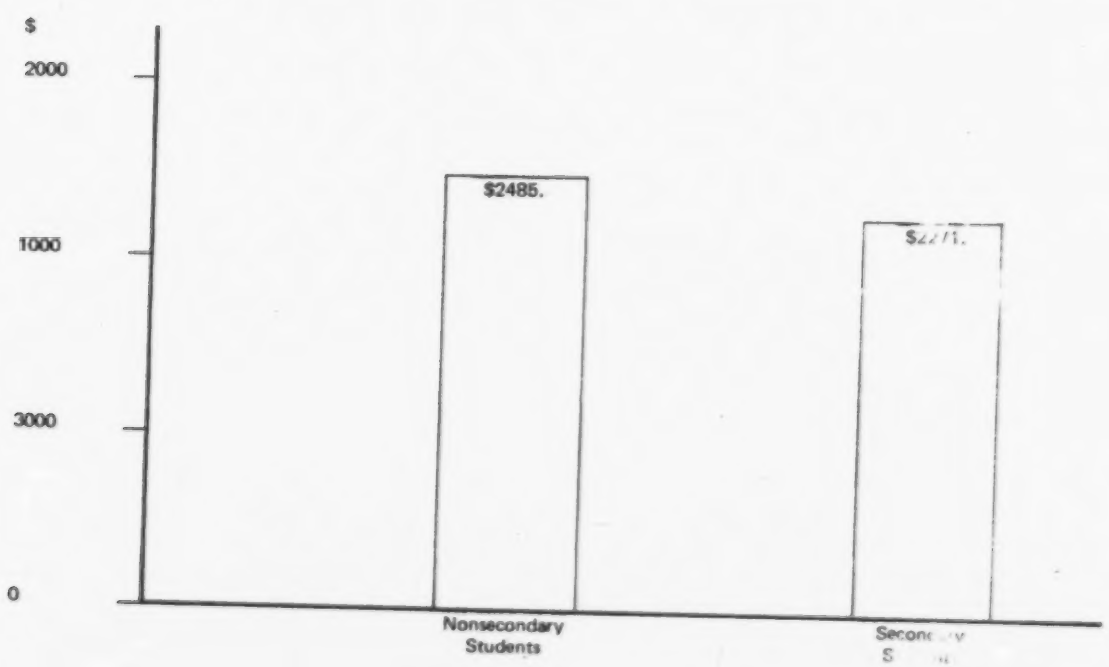
---

[1]Differences in public cost and hours of attendance did occur between programs, and are reported in Appendix H.

TABLE 9

AVERAGE PRIVATE OR STUDENT COSTS, IN DOLLARS, BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)





variance, comparisons between programs and between secondary and nonsecondary students in all programs of private costs per student and hours of attendance per student follows.[1]

The average private cost for the nursing program ($2823) was significantly ($p < .001$) higher than for either the cosmetology program ($2524), the air conditioning program ($1983), or the auto mechanics program ($1884). Largely contributing to the higher private cost for the nursing program was the longer period of time students spent in the nursing program as compared to the other three programs.

The average private cost for the cosmetology program ($2524) was significantly ($p < .001$) higher than the average private cost for either the auto mechanics program ($1884) or the air conditioning program ($1983). Largely contributing to the higher private cost for the cosmetology program (as compared to auto mechanics and air conditioning(was the greater length of time students spent in the cosmetology program.

There were no significant differences in average private cost between the auto mechanics program ($1884) and the air conditioning program ($1983). The fact that there was no significant difference in the number of hours of attendance between the auto mechanics program (924) and the air conditioning program (964) contributed largely to the similarity in private cost.

---

[1]See Appendixes F and H for analyses of variance of private costs between programs and between secondary and nonsecondary students in all programs, respectively.

Over all programs the average private cost for secondary students ($2271) was significantly ($p < .01$) lower than the average private cost for nonsecondary students ($2485). A significantly ($p < .001$) lower number of hours of attendance by secondary students (1073 hours) as compared to nonsecondary students (1227 hours) largely contributed to lower private costs for secondary students.[1]

Socio-demographic effects on costs

In order to analyze the effects of student socio-demographic characteristics on public costs and private costs per student for each program, multiple regression analysis was employed. Since public costs and private costs per student were a function of hours of attendance in a program, the multiple regression analyzed the relationship between student socio-demographic characteristics and hours of attendance in each program. The complete regressions appear in Appendix K, while a summary of the statistically significant socio-demographic variables appears in Table 10. A discussion of summary Table 10 follows.

The region in Florida where persons were enrolled in vocational education was significantly related to hours of attendance only in the cosmetology program. Persons enrolled in cosmetology in central Florida remained in training, on net (that is, holding the effects of all other variables

[1]There were differences in private costs between programs as reported in Appendix H.

constant), 33 hours less than persons who were enrolled in cosmetology in southeast Florida. There were no significant differences in hours of attendance between the other regions.

TABLE 10

SUMMARY OF MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON STUDENT HOURS OF ATTENDANCE IN EACH PROGRAM

Socio-Demographic Variables	Programs			
	Auto Mechanics	Air Conditioning	Practical Nursing	Cosmetology
Region	SR	NSR	NSR	SR[d]
Race	SR[b]	NSR	NSR	SR[d]
Marital Status	SR[b]	SR[b]	SR[d]	NSR
Father's Annual Income	SR[a]	SR[d]	SR[d]	SR[d]
Age	NSR	SR[a]	NSR	NSR
Father's Education	SR[a]	NSR	NSR	NSR
Mother's Education	SR[c]	SR[b]	NSR	NSR

SR = Significantly Related.

NSR = Not Significantly Related.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

Race was significantly related to the number of hours of attendance in the auto mechanics and cosmetology programs. White persons attended the auto mechanics programs, on net, 397 hours less than did nonwhite persons. Likewise, white persons attended the cosmetology program 56 hours less than nonwhite persons.

Marital status was significantly related to the number of hours of attendance in all programs except cosmetology. Single persons attended the auto mechanics and air conditioning programs, on net, 320 and 298 hours less than separated, widowed or divorced persons in the auto mechanics and air conditioning programs, respectively. Similarly, married persons attended the nursing program, on net, 76 hours more than separated, widowed or divorced persons in the nursing program.

Students' fathers' annual incomes were significantly related to the number of hours of attendance in all programs. In the auto mechanics program higher categories of income ($8001 - $9000 and $10,001 or above) were associated with a lower number of hours of attendance (268 and 428 hours, respectively) as compared to similar persons whose fathers' annual incomes were in the lowest category (up to $4000). In the nursing program, however, a higher category of income ($9001 - $10,000) was associated with a higher number of hours of attendance (210 hours) as compared to persons whose fathers were in the lowest income category (up to $4000). In the air conditioning and cosmetology programs, persons whose fathers' annual incomes were in the $4001 - $5000 category

took 364 and 419 hours less, respectively, than persons whose fathers' annual incomes were in the lowest category (up to $4000).

Age was significantly related to hours of attendance in only the air conditioning program. For each year older a person was, his hours of attendance in the air conditioning program decreased by 18 hours.

Father's education was significantly related to hours of attendance in only the auto mechanics program. Hours of attendance increased at the rate of 32 hours for each additional year of father's education.

Mother's education was significantly related to hours of attendance in the auto mechanics and air conditioning programs. As mother's education increased, hours of attendance in the auto mechanics program increased at the rate of 44 hours for each additional year of mother's education; in the air conditioning program hours of attendance increased at the rate of 56 hours per year.

Comparison and Analysis of Benefit-Cost Ratios

In order to determine the return on investment in vocational education programs, program benefits were linked to program costs[1] in the form of benefit-cost ratios, which served as economic efficiency indices of vocational education

[1] A discussion and correlation analysis of the relationship between public costs and public benefits, and between private costs and private benefits appears in Appendix L.

programs.[1] The purpose of benefit-cost ratios was to provide economic indicators for evaluating a program by itself and in relation to other programs.

Since benefits occur over future time periods, benefits were discounted back to their present value, thereby making benefits comparable with present value costs. The resultant figure was a discounted benefit-cost ratio.

Benefit-cost ratios are equivalent to the percentage rate of annual return on investment (cost) in vocational education programs and the reciprocal of the benefit-cost ratio is equivalent to the number of years it will take a person (or society) to receive a "total return" on his (its) investment in vocational education programs.

Average public and private benefit-cost ratios for each program and for secondary and nonsecondary students in all programs, discounted at 10 per cent, appear in Tables 11 and 12. In themselves, benefit-cost ratios show that all programs had a very positive rate of return on investment, both for the individual and for society although investment returns differed between programs.

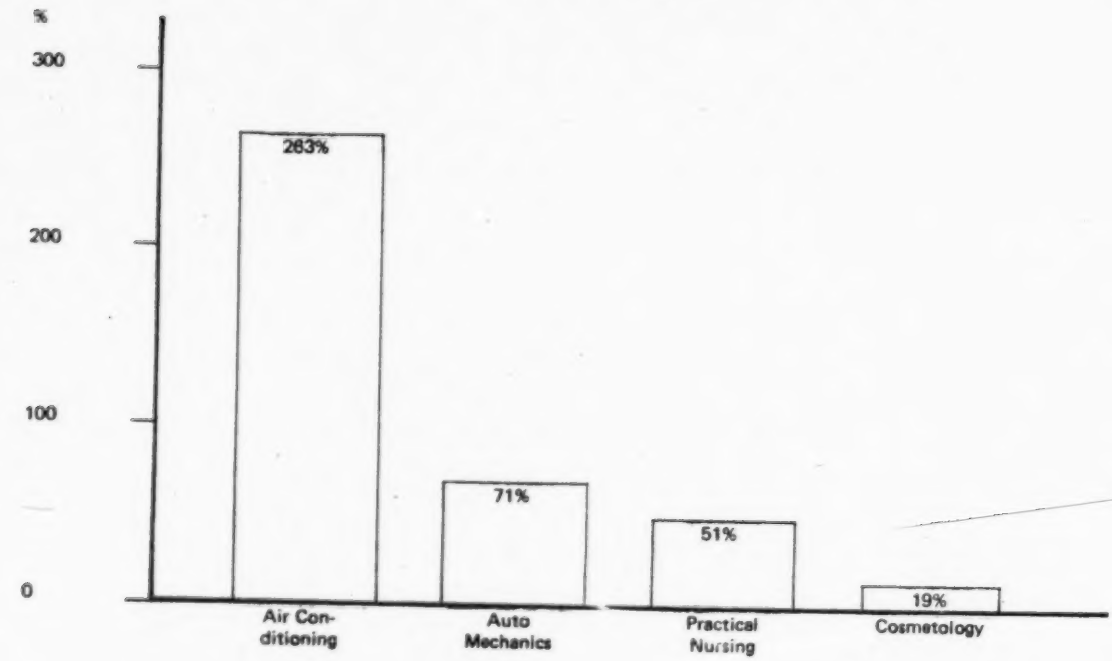
Based upon the statistical technique of analysis of

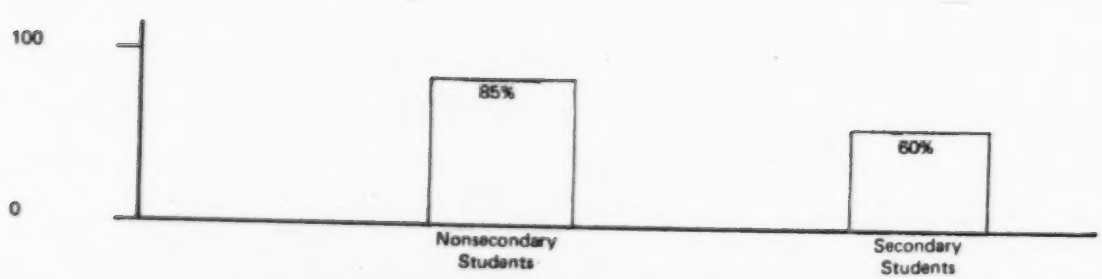
---

[1]The benefit-cost ratios reported herein should not be considered precise indices of the economic efficiency of vocational education programs nor secondary versus nonsecondary student economic behavior. Rather, the calculated public and private benefit-cost ratios should be thought of as direction indicators for public and private investment in vocational education. In addition, these benefit-cost ratios are limited to monetary measures which, perhaps, are only minor criteria in evaluating public and private investment in vocational education.

TABLE 11

AVERAGE PUBLIC BENEFIT-COST RATIOS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)[1]

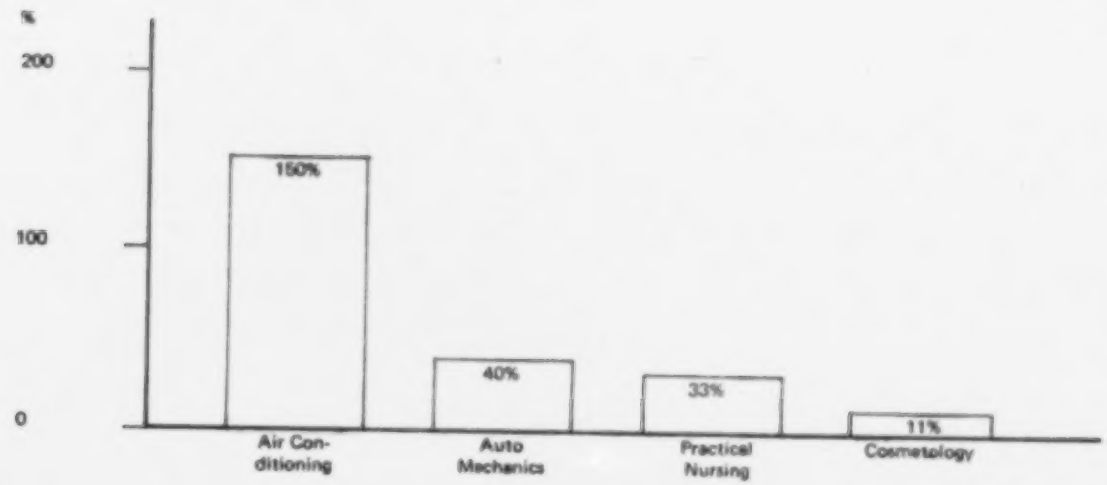


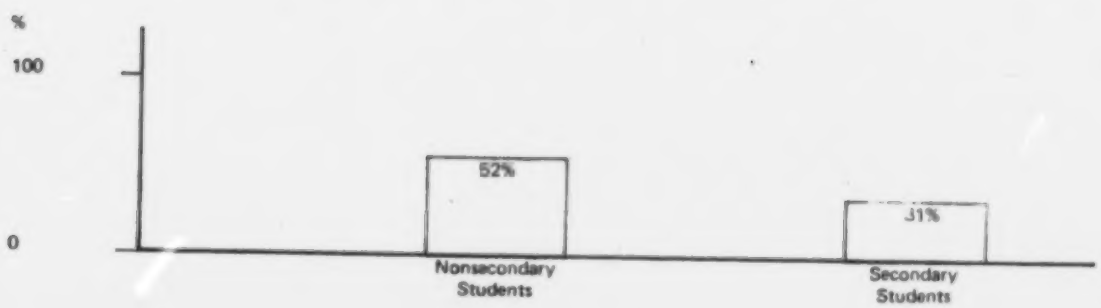


[1] Benefits were discounted in the benefit-cost ratio at a 10 per cent rate. See section entitled Methodology for Determining Benefit-Cost Ratios in previous chapter for a discussion of the discounting technique.

TABLE 12

AVERAGE PRIVATE OR STUDENT BENEFIT-COST RATIOS BY PROGRAMS AND BY SECONDARY AND NONSECONDARY STUDENTS IN ALL PROGRAMS (PER STUDENT)[1]





[1] Benefits were discounted in the benefit-cost ratio at a 10 per cent rate. See section entitled Methodology for determining Benefit-Cost Ratios in previous chapter for a discussion of the discounting technique.

variance, comparisons and analyses of average public and private benefit-cost ratios between programs and between secondary and nonsecondary students in all programs follow.[1]

The public benefit-cost ratio for the air conditioning program (2.63) was significantly ($p < .001$) higher than for either the auto mechanics program (.71), the nursing program (.51), or the cosmetology program (.19). Similarly, the private benefit-cost ratio for the air conditioning program (1.50) was significantly ($p < .001$) higher than for either the auto mechanics program (.40), the nursing program (.33), or the cosmetology program (.11).

There were no significant differences in public benefit-cost ratios between either the auto mechanics program, the nursing program or the cosmetology program. Likewise, there were no significant differences in private benefit-cost ratios between these programs.

The reason for the comparatively high public and private benefit-cost ratios for the air conditioning program was because the air conditioning program had the lowest public cost, and next lowest private cost,[2] and the highest public and private benefits of the four programs. Thus, whe

---

[1] See Appendixes F and H for analyses of variance of public and private benefit-cost ratios between programs and between secondary and nonsecondary students in all programs, respectively.

[2] The average private costs for the air conditioning program were only $101 more than average private costs for cosmetology, the lowest private cost program.

comparatively high benefits were combined with comparatively low costs, the results were comparatively high benefit-cost ratios.

Separate evaluations of benefits and costs, however, do not always yield such simple results. For example, the public and private costs of the nursing program were significantly higher than either the cosmetology program or the auto mechanics program. If a comparison between these three programs were based upon costs alone, the obvious choice for the worst program would have been the nursing program, since it had the highest costs. However, when benefits of these programs were joined with costs in the form of benefit-cost ratios, the resultant evaluations (based on both benefits and costs) revealed no significant differences in the public and private benefit-cost ratios for these programs. Thus, in terms of returns on investment, nursing, cosmetology, and auto mechanics did not differ significantly.

Over all programs the average public benefit-cost ratio for nonsecondary students (.85) was significantly ($p < .05$) higher than for secondary students (.60). Similarly, the average private benefit-cost ratio for nonsecondary students (.52) was significantly higher than the average private benefit-cost ratio for secondary students (.31).[1]

The higher public cost for nonsecondary students ($1838) as compared to secondary students ($1488) was more

---

[2]There were differences in public and private benefit-cost ratios between programs, as reported in Appendix H.

than offset by the higher public benefits for nonsecondary students ($1224) as compared to the public benefits for secondary students ($940). In terms of private costs and benefits, on the average, the higher private costs for nonsecondary students ($2485) as compared to secondary students ($2271) were also more than offset by the higher private benefits for nonsecondary students ($1037) as compared to secondary students ($774). Thus, in terms of economic returns as measured by benefit-cost ratios, nonsecondary students received higher returns on investment than secondary students, both on public investment and private investment.

In terms of public investment returns, society invested (public costs), on the average, a total of $1312 per student in the air conditioning program which yielded a rate of return of 263 per cent per year, thereby receiving a total return on its investment in less than six months. The following table summarizes the public investment returns for the other programs.

	Society Invested	Society Received	
		Rate of Return	Total Return on Investment
Auto Mechanics	$1342	71%	1.4 years
Practical Nursing	$2076	51%	1.9 years
Cosmetology	$1777	19%	5.2 years

Over all programs society invested (public cost), on the average, a total of $1488 per secondary student which yielded a rate of return of 60 per cent per year, thereby

receiving a total return on its investment in 1.7 years. For society's average investment (public cost) of $1885 per non-secondary student, society realized a rate of return on 85 per cent per year, thereby receiving a total return in 1.3 years. Thus, society's comparatively higher investment in nonsecondary students yielded comparatively higher rates of return, and was therefore more profitable, on the average, than its lower investment in secondary students.

In terms of investment returns to individuals, a student who attended the air conditioning program invested (private cost), on the average, a total of $1983 (comprised of foregone earnings and direct costs for tuition, books, supplies, uniforms, and special equipment) which yielded a rate of return of 150 per cent per year, thereby receiving a total return on his investment in eight months. The following summarizes student investment returns for the other programs.

	Student Invested	Student Received	
		Rate of Return	Total Return on Investment
Auto Mechanics	$1884	40%	2.5 years
Practical Nursing	$2823	33%	3.0 years
Cosmetology	$2523	11%	9.0 years

Over all programs, a secondary student invested (private cost), on the average, a total of $2271 which yielded a rate of return of 31 per cent per year thereby receiving a total return on his investment in 3.2 years. Similarly, a

nonsecondary student invested (private cost), on the average, $2485 which yielded a rate of return of 52 per cent per year, thereby receiving a total return on his investment in 1.9 years. Thus, a nonsecondary student's comparatively higher investment in vocational education yielded comparatively higher rates of return and therefore, on the average, was more profitable than a secondary student's investment in vocational education.

CHAPTER IV

A BENEFIT-COST PLANNING MODEL

Throughout this study, one of the objectives of the author was to analyze data that will be useful to educational decision makers and prospective vocational education students. This chapter incorporates the procedures and data used in the computation of the economic return indicators of vocational education programs--benefit-cost ratios--into a model for simulating and projecting the economic returns of vocational education programs.

While the evaluation methodology was oriented toward what had actually occurred in the past--ex post evaluation--the model presented in this chapter is oriented toward the future--ex ante evaluation. Since ex ante evaluations are usually based upon ex post data and evaluations, the evaluation methodology presented in Chapter II, and the results of the analysis from Chapter III serve as input to the benefit-cost planning model.

Figure 3 on the following page illustrates the flow chart design of a benefit-cost planning model for projecting the benefit-cost ratios of vocational education programs.

Historical data on program benefits, costs, benefit-cost ratios, and student socio-demographic characteristics

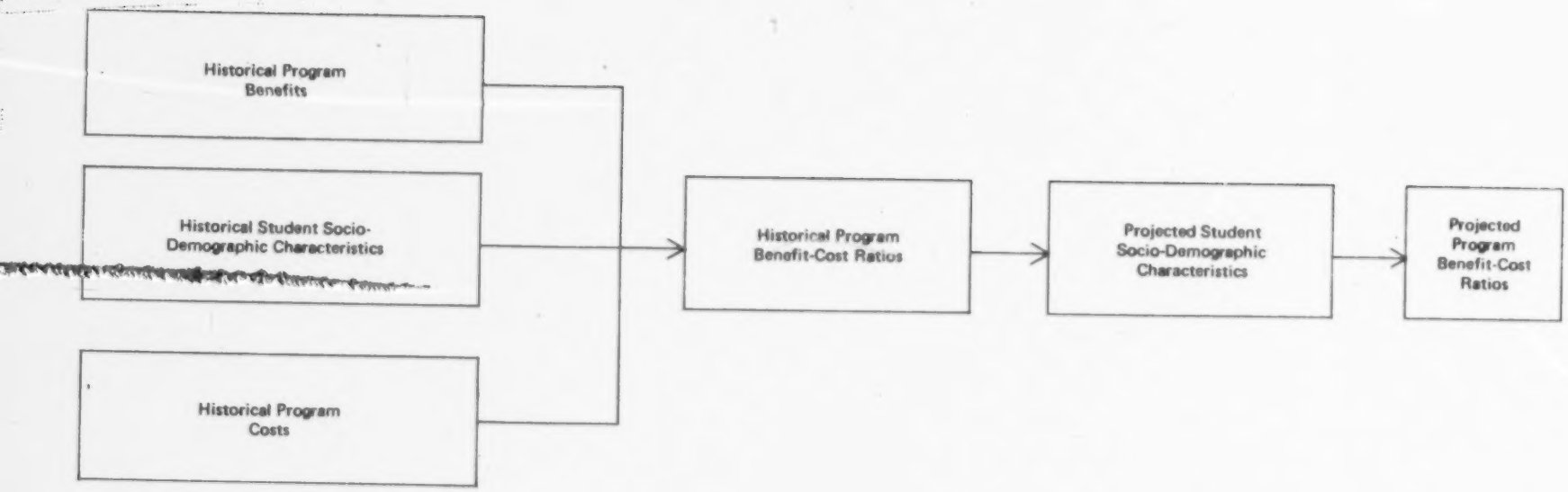


FIGURE 3

A BENEFIT-COST PLANNING MODEL

may be determined by using the algorithms presented in Chapter II and analyzed in Chapter III. Estimated student socio-demographic characteristics can be obtained from administering the questionnaire used in this study to prospective vocational education students[1] or by extrapolating from past trend data.

When the projected socio-demographic characteristics for a group of students are combined in a mathematical formula which has been derived for a particular vocational education program, the results can indicate the projected economic returns of that program, measured in terms of the benefit-cost ratio.

One statistical technique for projection purposes is multiple linear regression. The basic form of the equation for multiple linear regression is:

$$(1) \quad Y = a + b_1X_1 + b_2X_2 + \ldots b_nX_n$$

where:

Y represents the dependent variable (benefit-cost ratio);

a represents the value of Y when all X = 0 (intercept term);

b represents the regression coefficient or the amount by which the value of Y changes with one unit change in X; and

X represents the unit measure of the change in Y.

---

[1]The questionnaire must be modified for projection purposes, since prospective students will not know their future employment patterns nor their salaries. Thus, these items must be deleted for projection purposes.

Thus, the multiple regression equation can utilize historical or trend data on the relationship between student socio-demographic variables and benefit-cost ratios in order to project the dependent variable (benefit-cost ratio) into the future.

Table 13 is a summary of the socio-demographic variables which were significantly related to the private benefit-cost ratio in each of the four programs.[1] For illustration purposes the significant variables in Table 13 for the nursing program are entered into the equation discussed below.

As shown in summary Table 13, ex post evaluation data revealed that the following socio-demographic (independent) variables were significantly associated with the private benefit-cost ratio for students who attended the nursing program. Those variables were: region of Florida where a student attended the program and where he was employed; relation of employment to vocational training (relatedness index); amount of involuntary unemployment; number of children; and high school level completed.

As a practical example of the prediction equation, assume that a group of nursing students will have the following socio-demographic characteristics which are significant to the regression equation: trained and employed in southeast Florida; 1.5 relatedness index; 3 children; completed

[1]The complete multiple regression analysis for private benefit-cost ratios appears in Appendix M.

TABLE 13

SUMMARY OF MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE BENEFIT-COST RATIOS FOR EACH PROGRAM

Socio-Demographic Variables	Programs			
	Auto Mechanics	Air Conditioning	Practical Nursing	Cosmetology
Region	SR[c]	SR[a]	SR[a]	NSR
Relatedness Index	NSR	SR[d]	SR[c]	NSR
Additional Related Training	SR[b]	NSR	NSR	SR[c]
Race	SR[d]	SR[d]	NSR	NSR
Secondary Student	SR[a]	NSR	NSR	SR[a]
Father Lived with Family	SR[a]	SR[b]	NSR	NSR
Father's Annual Income	SR[a]	SR[c]	NSR	SR[c]
Hours of Attendance	NSR	NSR	SR[a]	NSR
Involuntary Unemployment	NSR	NSR	SR[a]	NSR
Age	NSR	NSR	NSR	SR[b]
Number of Children	NSR	NSR	NSR	SR[b]
High School Grade Point Average	SR[a]	NSR	NSR	NSR
High School Level Completed	NSR	NSR	SR[b]	NSR
Father's Education	NSR	SR[c]	NSR	NSR
Mother's Education	SR[c]	SR[b]	NSR	NSR

SR = Significantly Related

NSR = Not Significantly Related

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

4 years of high school; and attended the nursing program for 1200 hours.

When the values for these socio-demographic characteristics (independent variables) are inserted into the regression equation, it provides a projection of the private benefit-cost ratio (dependent variable) for the nursing program as follows:

$$(2) \quad Y = -1.21 + (-.28)(1) + (.25)(1.5) + (-.05)(3) + (.16)(4) + (.001)(1200)$$

$$Y = .57.$$

The projected average private benefit-cost ratio for these students in the nursing program is .57. In other words, students with the assumed socio-demographic characteristics will, on the average, realize a rate of return of 57 per cent on their investment in the nursing program.

While the above regression equation illustrates the use of the model for projecting private benefit-cost ratios, the benefit-cost planning model also can be used for projecting public benefit-cost ratios for vocational education programs. Substituting historical public benefits, costs, and benefit-cost ratios for private benefits, costs, and benefit-cost ratios will enable projection of public benefit-cost ratios.

The projection equation as illustrated is only for the nursing program and the set of data assumed above. As the program and data change so will the projection equation.

The reader must also recognize that actual private benefit-cost ratios may differ from that which was projected as a result of factors separate from different student socio-demographic characteristics. The actual private benefit-cost ratio may be more or less than the projected one due to unpredictable effects of cyclical and/or irregular forces. For example, changes in labor market conditions or educational technology which reduce the amount of time in a program and thus costs, are difficult to predict, but will affect the actual private benefit-cost ratio in the future.

CHAPTER V

SUMMARY AND CONCLUSIONS

With increasing demands being placed upon educational funders and education decision makers regarding the efficient allocation of public resources, and the problems of educational choice which confront students regarding the allocation of one of their most valuable resources--time, the need for evaluation and planning of educational programs is patent. Intrinsic to the educational evaluation and planning process is the need to link educational costs (public investment of tax dollars, and students' investment of time and money) with educational benefits (public and student economic returns).

When costs are joined with benefits, the resultant figure, a benefit-cost ratio, provides evaluative indications of the historical economic success of vocational education programs. In addition, data generated in the calculation of historical benefit-cost ratios can also serve as input for planning purposes by providing mathematical formulae for projecting returns on investment in vocational education programs into the future.

This statewide study compared and analyzed the benefits, costs, and benefit-cost ratios of students who attended

selected vocational education programs in Florida. Incorporating existing program cost data with data collected by means of student follow-up questionnaires, this study consisted of four principal phases.

The first phase was concerned with selection of programs and classification of study participants. Vocational education programs located at area vocational centers in four designated geographical regions of Florida were selected. These programs were: (1) auto mechanics, (2) air conditioning and refrigeration, (3) practical nursing, and (4) cosmetology. Study participants were classified in terms of (1) graduates, (2) early leavers (those who left the vocational program before normal graduation time), (3) students who attended vocational education while enrolled in day high school (secondary students), and (4) students who attended vocational education while not enrolled in day high school (nonsecondary students).

The second phase was concerned with developing methodologies for determining program benefits, costs, and benefit-cost ratios. Criteria and algorithms for measuring benefits relative to labor market performance were developed. Costs were determined by algorithms based upon a student's length of time in attendance in a given program. Benefits were then linked to costs in the form of discounted benefit-cost ratios. The discounted benefit-cost ratio was a number which indicated the percentage rate of return on investment in each vocational education program.

The third phase was concerned with an historical evaluation. Historical benefit-cost profiles for each vocational education program and for secondary and nonsecondary students in all programs were constructed. Then the benefit-cost profiles were analyzed and compared between vocational programs and between secondary and nonsecondary students.

The fourth phase incorporated the procedures and data used in the historical evaluation of the economic returns from vocational-education programs into a benefit-cost planning model.

The most cogent findings and conclusions of this study were as follows:

1. The benefit-cost profiles which were constructed indicated that rates of return from investment in each of the four selected vocational education programs were positive and significant. The average rate of return was 76 per cent per year on investment of public tax dollars and 54 per cent per year on investment of students' time and money. In other words, on the average, society will recoup its average investment of $1716 per student in 1.3 years, and, on the average, a student will recoup his average investment of $2411 in 1.9 years.

   These findings suggest that promotion and expansion of vocational education in Florida would be a wise economic investment.

2. There were statistically significant differences in the rates of return on investment between the air

conditioning program, and either the auto mechanics, practical nursing, or cosmetology programs. Between the latter three programs, however, there were no statistically significant differences in rates of return on investment.

These findings suggest that an optimal allocation of resources between these four programs should be more heavily weighted toward the air conditioning program.

3. There were statistically significant differences in rates of return on investment between secondary and nonsecondary students. On both public and student investments, nonsecondary students had higher rates of return than did secondary students.

   This finding suggests that, in economic terms, vocational education is more profitable at the nonsecondary level than at the secondary level.

4. On the average, student costs ($2411) of vocational education are greater than public costs ($1716). On the average, student costs represented about 60 per cent of the total cost of education.

   In order to provide students with information necessary for allocating their resources, it is suggested that summaries of studies such as this be provided to students and guidance counselors.

5. The methodology which was developed in this study proved

effective in conducting a benefit-cost study of vocational education programs in Florida.

This methodology could be used in several ways in addition to studies of this kind. For example, it could be used (1) to contrast the economic efficiency between vocational education programs offered in the public sector and those offered in the private sector, and/or (2) to contrast the economic efficiency of discreet components of individual programs, such as alignment and wheel balance, power train, and engine rebuild in an auto mechanics program.

6. A benefit-cost planning model was developed which proved effective for projecting rates of return on investment in vocational education into the future.

An educational planner or student contemplating enrolling in vocational education could use the benefit-cost planning model to assist in the allocation of resources in order to maximize public and student benefits.

APPENDIX A

FOLLOW-UP QUESTIONNAIRE

1. What was the name of the vocational-technical education program you took and vocational school you attended?
   Program _____ School _____
2. About how many hours of study did you complete? _____ hours Date started: Month _____ Year _____
   Date completed: Month _____ Year _____
3. Have you had *related* working experience prior to completion of your training listed in number (1) above? Yes ____ No ____ If YES: How many weeks of experience have you had? _____ weeks
4. While taking the training in number (1) above, were you employed either full-time or part-time? Yes____ No ____
   If YES: On the average how many hours per week did you work? _____ Hours
5. Since completion, have you had any *additional* formal vocational-technical training? Yes ____ No ____ If YES: Was it in the same field as your training listed in number (1) above? Yes ____ No____ How long was it? _____ Hours
6. Since completion, have you attended a community college or a four year college or university for any period of time? Yes ____ No ____
7. Since completion, have you been on active duty in the military for three months or longer? Yes ____ No ____ If YES: When did you go on active duty? Month _____ Year _____ When were you discharged? Month _____ Year _____
8. Since completion, have you held a job for one month or longer? Yes____ No____ If YES: Starting with your present or most recent job and working down to your first job after completion of vocational training, please answer below. Again, this information is strictly confidential.

	What is (was) this job called?	Starting Date	Ending Date	Weekly salary before taxes & deduction*	Average No. of hours per week worked	Is (was) this job related to your vocational training program?	Location of job
Present or Most Recent Job		_____ Month _____ Year	_____ Month _____ Year	____ Up to $25 ____ 26-50 ____ 51-75 ____ 76-100 ____ 101-125 ____ 126-150 ____ 151 or over	____ hours	__ Very related __ Related __ Unrelated	_____ City _____ State
Next Most Recent Job		_____ Month _____ Year	_____ Month _____ Year	____ Up to $25 ____ 26-50 ____ 51-75 ____ 76-100 ____ 101-125 ____ 126-150 ____ 151 or over	____ hours	__ Very related __ Related __ Unrelated	_____ City _____ State
Next Job		_____ Month _____ Year	_____ Month _____ Year	____ Up to $25 ____ 26-50 ____ 51-75 ____ 76-100 ____ 101-125 ____ 126-150 ____ 151 or over	____ hours	__ Very related __ Related __ Unrelated	_____ City _____ State
Next Job		_____ Month _____ Year	_____ Month _____ Year	____ Up to $25 ____ 26-50 ____ 51-75 ____ 76-100 ____ 101-125 ____ 126-150 ____ 151 or over	____ hours	__ Very related __ Related __ Unrelated	_____ City _____ State

*Present weekly salary or weekly salary when you *left* job.

[1]Portions of this questionnaire were adapted from Kaufman, et al., Cost-Effectiveness, pp. 239-46.

APPENDIX A.--(Continued)

9. Since your completion, have you been involuntarily unemployed for one month or longer? Yes ___ No ___ If YES: How many months? _____ months

10. Are you: ____ Male ____ Female

Are you: ____ Single ____ Married ____ Separated, Divorced or Widowed

What is your age? ____

Are you: ____ White ____ Black ____ Other

How many children do you have? _____

11. What was your overall grade point average in high school? _____

12. Were you enrolled in day high school when you took the vocational training in (1) above? Yes ____ No ____

13. What is the highest year of high school you completed? _____

14. Did your father live with your family for the majority of your elementary and high school years? Yes ____ No ____ If YES: What was the highest year of school your father completed? _____year

15. What is your father's annual income?

__Up to $4,000
__4,001-5,000
__5,001-6,000
__6,001-7,000
__7,001-8,000
__8,001-9,000
__9,001-10,000
__10,001 or over

16. What was the highest year of school your mother completed? _____

Please detach questionnaire, place in self addressed postage paid envelope and mail.
Thank you for your cooperation.

APPENDIX B

THE FLORIDA STATE UNIVERSITY

STUDY GROUP FOR FLORIDA STATE-WIDE EVALUATION OF VOCATIONAL-TECHNICAL EDUCATION

TALLAHASSEE, FLORIDA

Dear Former Vocational-Technical Education Student:

In order to improve vocational-technical education in Florida a statistical study is being conducted by means of the attached questionnaire. Through your cooperation in filling out, detaching, and mailing back the questionnaire in the enclosed addressed and stamped envelope, a research study is being conducted that will enable Florida vocational schools to better serve the needs of their students.

Your name is NOT wanted. All of the information collected will be combined and none of *your* information will *ever* be divulged.

Thank you very much for your cooperation.

APPENDIX C

WAGE RATES FOR UNSKILLED WORKERS IN FLORIDA BY REGION

	Lowest Prevailing Wage Rate	Mid-Points	Highest Prevailing Wage Rate
Northwest and North Florida			
Ft. Walton	$1.60	$1.80	$2.00
Gainesville	1.25	1.95	2.65
Lake City	1.40	1.81	2.23
Marianna	1.40	1.62	1.85
Perry	1.60	1.80	2.00
Tallahassee	1.00	1.65	2.30
Mean		1.77	
Central Florida			
Daytona	1.30	2.07	2.85
Lakeland	1.20	1.82	2.50
Leesburg	1.68	1.92	2.25
Ocala	1.60	1.67	1.75
Orlando	1.45	1.60	1.75
Sanford	1.40	1.55	1.70
Mean		1.78	
Southwest Florida			
Bradenton	1.50	1.95	2.40
Clearwater	1.60	2.35	3.10
Ft. Myers	1.40	2.20	3.00
Sarasota	1.60	1.80	2.00
St. Petersburg	1.60	2.05	2.50
Tampa	1.40	2.70	4.00
Winter Haven	1.60	2.06	2.52
Mean		2.16	
Southeast Florida			
Ft. Lauderdale	1.45	2.40	3.35
Ft. Pierce	1.25	2.16	3.07
Hollywood	1.50	1.75	2.00
Key West	1.25	1.87	2.50
Miami	1.45	2.40	3.35
West Palm Beach	1.45	2.06	2.52
Mean		2.17	

Source: Florida Department of Commerce, "Survey of Wage Rates for Unskilled Workers in Florida" (unpublished study, Tallahassee, Florida: 1970).

APPENDIX D

AVERAGE PUBLIC COSTS PER FULL-TIME EQUIVALENT (FTE)
(ONE FTE EQUALS 810 STUDENT HOURS OF ATTENDANCE)

Region[a]	Year	Auto Mechanics	Air-Conditioning	Nursing	Cosmetology
North Florida	1968-69	$1112[b]	$	$1326	$1302
	1969-70	1178[c]		1405	1379
	1970-71	1219[d]		1454	1428
Central Florida	1968-69	1047	1038	1219	1391
	1969-70	1109	1100	1291	1474
	1970-71	1148	1139	1336	1526
Southwest Florida	1968-69	1051	1106	968	1050
	1969-70	1113	1172	1025	1112
	1970-71	1152	1213	1061	1151
Southeast Florida	1968-69	1077	806	938	808
	1969-70	1135	854	994	856
	1970-71	1175	884	1029	886

[a]Inter-regional differences in program public costs per FTE primarily were due to (1) inter-retional price differentials of teacher salaries and costs of equipment, supplies, etc., and (2) different program utilization rates as measured by the ratio of the capacity number of student hours of attendance to the actual number of student hours of attendance.

[b]1969-70 figure reduced by 3.4 per cent, the implicit price deflator used in the calculation of GNP. Source of implicit price deflator: U.S. Department of Commerce, Business Conditions Digest (Washington, D.C.: Government Printing Office, 1972), p. 216.

[c]1970-71 figure reduced by 3.4 per cent, the implicit price deflator used in the calculation of GNP.

[d]Weighted average of all such courses at area vocational centers included in the study. Figure included social operating costs and costs accruing from investments in fixed assets. This figure was derived from working papers for the Associated Consultant's report Current Operating Costs, 1970-71, Florida Area Vocational/Technical Centers.

Source: Associated Consultants in Education, Inc. Current Operating Costs, 1970-71, Florida Area Vocational/Technical Centers (Tallahassee, Florida: 1972).

APPENDIX E

PRIVATE DIRECT COSTS PER FULL-TIME EQUIVALENT (FTE)
(ONE FTE EQUALS 810 STUDENT HOURS OF ATTENDANCE)

Region	Year	Auto Mechanics	Air-Conditioning	Nursing	Cosmetology
North Florida	1968-69	$58[a]		$108	$51
	1969-70	61[b]		114	54
	1970-71	63[c]		118	56
Central Florida	1968-69	51	46	60	82
	1969-70	54	49	64	87
	1970-71	56	51	66	90
Southwest Florida	1968-69	43	74	87	69
	1969-70	46	78	92	73
	1970-71	48	81	95	76
Southeast Florida	1968-69	32	39	68	49
	1969-70	34	41	72	52
	1970-71	35	42	75	54

[a]1969-70 figure reduced by 5.6 per cent, the implicit price deflator used in the calculation of GNP. Source of implicit price deflator: U.S. Department of Commerce, Business Conditions Digest (Washington, D.C.: Government Printing Office, 1972), p. 216.

[b]1970-71 figure reduced by 3.4 per cent, the implicit price deflator used in the calculation of GNP.

[c]Cost figures furnished by institutional administrators at selected area vocational centers.

Source: Institutional administrators at selected area vocation centers. Costs include student costs for tuition, books, supplies, uniforms, and special equipment. Costs figures were inflated by a factor of 1.06 in order to impute opportunity costs. Costs are an average of the selected programs within a region, weighted according to the number of student hours of attendance.

APPENDIX F

ANALYSES OF VARIANCE OF MEANS OF INDEPENDENT AND DEPENDENT VARIABLES BETWEEN PROGRAMS[1]

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology		F-Ratio
	$\bar{X}$	(S)	$\bar{X}$	(S)	$\bar{X}$	(S)	$\bar{X}$	(S)	
Independent Variables									
Hours of Attendance	923.82	(350.76)	963.59	(330.96)	1378.89	(193.15)	1219.87	(45.97)	61.27[a]
Age	21.05	(4.28)	29.37	(10.90)	33.33	(11.36)	22.45	(5.15)	29.53[a]
High School Grade Point Average	2.39	(.37)	2.54	(.43)	2.59	(.48)	2.5	(.43)	2.87[c]
Father's Education[2]	10.98	(4.72)	10.44	(4.52)	10.40	(4.12)	10.65	(4.86)	1.42
Mother's Education	11.87	(2.04)	10.65	(2.38)	10.21	(3.17)	10.80	(2.29)	5.35[b]
Public Cost	$1342.00	(524.00)	1312.00	(487.00)	2076.00	(430.00)	1777.00	(453.00)	45.21[a]
Private Cost	$1884.00	(683.00)	1983.00	(694.00)	2823.00	(471.00)	2524.00	(284.00)	55.55[a]
Dependent Variables									
Relatedness Index	1.60	(.45)	1.68	(.46)	1.92	(.26)	1.95	(.20)	20.81[a]
Involuntary Unemployment (months)	.58	(1.34)	.17	(.57)	.87	(2.40)	.26	(1.02)	3.17[c]
Public Benefit	$ 987.00	(1348.00)	2646.00	(1653.00)	1252.00	(963.00)	393.00	(1161.00)	35.65[a]
Private Benefit	$ 816.00	(1113.00)	2230.00	(1400.00	1056.00	(831.00)	333.00	(994.00)	35.61[a]
Public Benefit-Cost Ratio[3]	.71	(1.70)	2.63	(3.34)	.51	(.52)	.19	(.76)	26.08[a]
Private Benefit-Cost Ratio[3]	.40	(.67)	1.50	(1.93)	.33	(.37)	.11	(.31)	27.09[a]
Number of Observations	62		46		99		101		

[1]This table analyzes differences in means between all programs. The test on the following page entitled Scheffe's Multiple Range Test for Differences between Program Means, reports significant differences between pairs of programs.

[2]Number of observations for Father's Education for each program is 32, 55, 74, and 85, respectively.

[3]Discounted at 10 per cent rate.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

$\bar{X}$ = group means.

(S) = Standard deviations.

APPENDIX F --(Continued)

SCHEFFE'S MULTIPLE RANGE TEST FOR DETERMINING DIFFERENCES OF MEANS OF INDEPENDENT AND DEPENDENT VARIABLES BETWEEN PAIRS OF PROGRAMS[1]

Variable		F-Ratio
Independent Variables		
Hours of Study	3 is greater than 1[a]	141.11
	4 is greater than 1[a]	60.19
	3 is greater than 2[a]	96.73
	4 is greater than 2[a]	37.10
	3 is greater than 4[a]	22.59
Age	2 is greater than 1[a]	25.41
	3 is greater than 1[a]	79.25
	3 is greater than 4[a]	81.44
Mother's Education	1 is greater than 3[b]	16.69
Social Cost	3 is greater than 1[a]	93.60
	4 is greater than 1[a]	33.48
	3 is greater than 2[a]	84.43
	4 is greater than 2[a]	31.47
	3 is greater than 4[a]	20.58
Private Cost	3 is greater than 1[a]	127.99
	4 is greater than 1[a]	67.35
	3 is greater than 2[a]	84.38
	4 is greater than 2[a]	35.22
	3 is greater than 4[a]	17.02
Dependent Variables		
Relatedness Index	3 is greater than 1[a]	37.05
	4 is greater than 1[a]	44.78
	3 is greater than 2[b]	18.88
	4 is greater than 2[a]	21.97
Involuntary Unemployment (months)	3 is greater than 2[d]	14.18
	3 is greater than 4[d]	7.15
Social Benefit	2 is greater than 1[a]	47.62
	1 is greater than 4[d]	8.88
	2 is greater than 3[a]	39.99
	2 is greater than 4[a]	105.12
	3 is greater than 4[a]	24.17
Private Benefit	2 is greater than 1[a]	48.61
	2 is greater than 3[a]	39.86
	2 is greater than 4[a]	104.72
	3 is greater than 4[a]	24.06
Social Benefit-Cost Ratio	2 is greater than 1[a]	36.39
	2 is greater than 3[a]	51.92
	2 is greater than 4[a]	72.06
Private Benefit-Cost Ratio	2 is greater than 1[a]	40.55
	2 is greater than [illegible]	54.58
	2 is greater than [illegible]	77.00

[1]Numbers 1 - 4 refer to programs as follows: 1 = auto mechanics; 2 = air conditioning and refrigeration; 3 = practical nursing; 4 = cosmetology.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

APPENDIX G

CHI SQUARE ANALYSIS OF QUALITATIVE INDEPENDENT VARIABLES BETWEEN PROGRAMS

	Auto Mechanics	Air-Conditioning	Practical Nursing	Cosmetology	Chi Square
Regions					
North Florida	12.9%	0.0%	23.2%	18.8%	31.84[a]
Central Florida	25.8	45.7	22.2	18.8	df = 9
Southwest Florida	33.9	26.1	26.3	16.8	
Southeast Florida	27.4	28.3	28.3	45.3	
Related Working Experience					
Yes	56.5	30.0	54.5	21.8	29.32[a]
No	43.5	50.0	45.5	78.2	df = 3
Additional Training					
Yes	17.7	15.2	22.2	6.9	9.43[b]
No	82.3	84.8	77.8	93.1	df = 3
Employed During Training					
Yes	72.6	69.6	26.3	46.0	42.41[a]
No	27.4	30.4	73.7	54.0	df = 3
Military Service					
Yes	11.3	8.7	0.0	0.0	
No	88.7	91.3	100.0	100.0	
Marital Status					
Single	77.4	32.6	17.2	32.7	61.55[a]
Married, Separated, Widowed, or Divorced	22.6	67.4	82.8	67.3	df = 3
Race					
White	88.7	91.3	81.8	93.1	6.67[d]
Non-white	11.3	8.7	18.2	6.9	df = 3
Level of Student					
Secondary Student	60.7	34.8	9.1	44.6	31.01[a]
Non-secondary Student	39.3	65.2	90.9	55.4	df = 3
High School Level Completed					
1-3 yrs.	12.9	6.5	7.1	7.9	2.09
4 yrs.	87.1	93.5	92.9	92.1	df = 3
Father's Annual Income					
Up to $6,000	13.5	17.9	17.5	10.8	4.54
6,001 - 8,000	30.8	21.4	20.0	27.7	df = 9
8,001 - 10,000	23.1	21.4	22.5	30.1	
10,001 or above	32.7	39.3	40.0	31.3	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

df = degrees of freedom.

APPENDIX H

ANALYSES OF VARIANCE OF MEANS OF INDEPENDENT AND DEPENDENT VARIABLES BETWEEN SECONDARY AND NONSECONDARY STUDENTS[1]

	Auto Mechanics		Air-Conditioning		Cosmetology		All Programs Combined	
	Mean	F-Ratio	Mean	F-Ratio	Mean	F-Ratio	Mean	F-Ratio
Independent Variables								
Hours of Attendance								
Secondary	915	.06	979	.05	1195	5.87	1073	19.74[a]
Nonsecondary	937		956		1240		1227	
Public Cost ($)								
Secondary	1315	.24	1297	.02	1612	12.01[a]	1488	30.01[a]
Nonsecondary	1381		1320		1911		1838	
Private Cost ($)								
Secondary	1898	.04	2149	1.42	2555	1.00	2271	8.10[b]
Nonsecondary	1864		1894		2499		2485	
Dependent Variables								
Relatedness Index								
Secondary	1.65	.91	1.53	2.53[d]	1.94	.39	1.77	4.70[b]
Nonsecondary	1.54		1.76		1.96		1.86	
Public Benefit ($)								
Secondary	1244	3.47[c]	1931	5.01[c]	333	.21	940	2.76[c]
Nonsecondary	607		3027		441		1224	
Private Benefit ($)								
Secondary	1028	3.48[c]	1602	5.41[b]	273	.29	774	3.37[c]
Nonsecondary	502		2565		381		1037	
Public Benefit-Cost Ratio[2]								
Secondary	.80	.20	1.64	2.25	.19	.00	.60	2.86[c]
Nonsecondary	.60		3.16		.19		.85	
Private Benefit-Cost Ratio								
Secondary	.50	.25	.90	3.27[c]	.09	.83	.35	2.98[c]
Nonsecondary	.38		2.01		.16		.58	
Number of Observations								
Secondary	37		16		45		107	
Nonsecondary	25		30		56		201	
Degrees of Freedom	2,60		2,44		2,99		2,306	

[1]The practical nursing program was omitted from a separate analysis because of the relatively small proportion of secondary students. Nine out of ninety-nine students were secondary students.

[2]Discounted at 10 per cent rate.

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

APPENDIX I

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PUBLIC BENEFITS FOR EACH PROGRAM

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology	
	b[1]	(S)[2]	b	(S)	b	(S)	b	(S)
Regions								
North Florida								
Central Florida	379.60	(304.65)	707.30[b]	(499.98)				
Southwest Florida[3]			-1338.22[b]	(502.36)	-724.44[a]	(177.56)		
Southeast Florida								
Related Working Experience								
Relatedness Index	555.25[b]	(302.87)	-656.34	(482.97)	384.99	(291.03)	761.20	(588.91)
Additional Training	1123.63[b]	(337.44)	429.76	(291.63)				
Additional Related Training			-4232.58[c]	(1958.86)			-532.49[c]	(261.97)
Race								
White	1446.75[b]	(470.95)	2529.72[b]	(889.40)				
Nonwhite[3]								
Secondary Student	730.48[b]	(268.37)					480.89[d]	(252.22)
Father Lived with Family								
Marital Status								
Single			-700.29	(458.91)				
Married							482.46[c]	(242.96)
Separated, Widowed, or Divorced[3]								
Father's Annual Income Data	-981.03[c]	(381.12)						
Father's Annual Income								
Up to $4,000[3]								
4,001 to 5,000								
5,001 to 6,000			-2466.41	(1481.43)				
6,001 to 7,000	-506.38	(404.34)						
7,001 to 8,000			-1014.47	(684.49)				
8,001 to 9,000	780.15[d]	(399.98)					925.76[c]	(362.77)
9,001 to 10,000			-1132.18	(998.85)			678.17[d]	(351.93)
10,000 or Above	1233.66[b]	(358.96)					500.23	(315.63)
Hours of Attendance	1.68[a]	(.42)						
Employed During Training					301.42[a]	(195.62)		
Involuntary Unemployment					-197.04[a]	(32.16)	275.20	(211.40)
Age							148.26[a]	((42.22)
Number of Children							-262.11[d]	(162.75)
High School Grade Point Average			1877.28[a]	(460.01)	218.06	(159.98)	472.13[d]	(258.68)
High School Level Completed								
Father's Education			64.56	(51.20)				
Mother's Education	63.76	(72.93)						
Number of Observations	62		46		99		101	
Coefficient of Determination	.60		.61		.64		.63	
Mean of Dependent Variable	987	(1347)	2646	(1653)	1252	(963)	393	(1181)
Intercept Term	-3684.30		-3724.01		-213.08		-6573.61	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

[1]b is the regression coefficient.

[2](S) is the standard error of the regression coefficient.

[3]This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor.

APPENDIX J

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE BENEFITS FOR EACH PROGRAM

	Auto Mechanics		Air-Conditioning		Practical Nursing		Cosmetology	
	b[1]	(S)[2]	b	(S)	b	(S)	b	(S)
Regions								
North Florida								
Central Florida	308.74	(251.90)	404.72	(407.17)	-213.48	(165.62)		
Southwest Florida			-979.67[c]	(423.69)	-806.96[a]	(163.57)		
Southeast Florida[3]								
Related Working Experience								
Relatedness Index	467.73	(250.43)	705.18[d]	(397.23)			811.75[d]	(490.00)
Additional Training	937.12	(279.01)	2504.12	(1274.83)	-244.72	(158.02)		
Additional Related Training			-1389.44	(1215.31)			-341.01[c]	(150.79)
Race								
White	1209.49[a]	(389.40)	2014.13[b]	(746.13)				
Nonwhite[3]								
Secondary Student	604.89	(221.90)					416.12[d]	(209.86)
Marital Status								
Single			-618.46	(387.50)				
Married					-225.00	(144.38)	394.60[d]	(202.16)
Separated, Widowed or Divorced[3]								
Father's Annual Income Data	-823.88[b]	(315.13)						
Father's Annual Income								
Up to $4,000[3]								
4,001 - 5,000								
5,001 - 6,000								
6,001 - 7,000	-413.27	(334.32)			-427.94	(345.50)		
7,001 - 8,000								
8,001 - 9,000	656.96[d]	(330.72)					773.64[c]	(301.84)
9,001 - 10,000							541.11[d]	(292.82)
10,001 or above	1029.29[a]	(296.80)					417.50	(262.62)
Hours of Attendance	1.40[a]	(.35)			.60[d]	(.35)		
Employed During Training					219.14	(155.83)	229.39	(175.90)
Involuntary Unemployment			-525.84[d]	(282.96)	-173.62[a]	(28.90)		
Age					17.95[c]	(7.64)	127.87[a]	(35.13)
Number of Children					-58.15	(45.10)	-212.67	(135.42)
High School Grade Point Average			1447.59[a]	(367.16)	186.18	(137.26)	380.63	(215.23)
High School Level Completed								
Father's Education			55.09	(41.90)				
Mother's Education	47.32	(60.30)						
Number of Observations	62		46		99		101	
Coefficient of Determination	.60		.59		.51		.54	
Mean of the Dependent Variable	816	(1112)	2230	(1400)	1056	(831)	333	(994)
Intercept term	-3008.92		-2430.63		-492.56		-5885.36	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

[1]b is the regression coefficient.

[2](S) is the standard error of the regression coefficient.

[3]This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor.

APPENDIX K

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON HOURS OF ATTENDANCE FOR EACH PROGRAM

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology	
	b[1]	(S)[2]	b	(S)	b	(S)	b	(S)
Regions								
North Florida								
Central Florida								
Southwest Florida[3]			-124.64	(92.65)			33.41[d]	(20.04)
Southeast Florida								
Race								
White	-397.14[b]	(126.83)					-55.50[d]	(30.91)
Nonwhite[3]								
Secondary Student					-98.11	(65.87)	-25.37	(15.98)
Father Lived with Family								
Marital Status								
Single	-319.54[b]	(117.82)	-297.94[b]	(111.37)				
Married					75.95[d]	(40.52)		
Separated, Widowed, or Divorced[3]								
Father's Annual Income Data								
Father's Annual Income								
Up to $4,000[3]								
4,001 - 5,000	-200.41	(154.93)	-364.19[d]	(205.93)			-419.35[a]	(56.54)
5,001 - 6,000			-236.94	(199.81)				
6,001 - 7,000					159.92	(104.44)		
7,001 - 8,000								
8,001 - 9,000	-267.53[d]	(141.43)						
9,001 - 10,000			-313.33	(193.48)	209.50[d]	(108.89)		
10,001 or Above	-427.72[a]	(114.03)					27.45	(21.30)
Employed During Training								
Age	17.82	(13.47)	-18.19[a]	(4.80)				
Number of Children	-195.91	(114.04)			-19.35	(12.39)		
High School Grade Pt. Average	133.08	(125.94)	102.98	(96.38)				
High School Level Completed								
Father's Education	32.29[a]	(8.74)						
Mother's Education	44.39[c]	(20.47)	56.38[b]	(17.98)				
Related Working Experience								
Number of Observations	62		46		99		101	
Coefficient of Determination	.43		.51		.15		.42	
Mean of Dependent Variable	924	(351)	964	(331)	1379	(193)	1220	(96)
Intercept Term	177.12		804.90		1361.00		1280.77	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

[1]b is the regression coefficient.

[2](S) is the standard error of the regression coefficient.

[3]This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted as deviations from this regressor.

APPENDIX L

A DISCUSSION AND CORRELATION ANALYSIS OF THE RELATIONSHIP BETWEEN COSTS AND BENEFITS

The relationship between public costs ard public benefits, and the relationship between private costs and private benefits were analyzed by means of simple correlation. If significant relationships existed, then it may have been possible to project public and private benefits on the basis of costs.

However, as seen in the following table, the correlations between either public costs and public benefits, or between private costs and private benefits were significant in only one case; for the auto mechanics program, private costs were significantly ($p < .05$) related to private benefits.

The nonsignificant correlations between costs and benefits in the vast majority (seven out of eight correlations) of cases suggests that knowledge about the costs of vocational education does little good relative to determining corresponding benefits. This supports the thesis that evaluation based upon costs alone is a rather weak form of evaluation, since costs were not significantly related to benefits.

APPENDIX L.--(Continued)

CORRELATION ANALYSIS BETWEEN PUBLIC COSTS AND PUBLIC BENEFITS AND BETWEEN PRIVATE COSTS AND PRIVATE BENEFITS FOR EACH PROGRAM

	Programs			
Correlation Between	Auto Mechanics N = 62	Air Conditioning N = 46	Practical Nursing N = 99	Cosmetology N = 101
Public Costs and Public Benefits	.186	.040	.194	-.127
Private Costs and Private Benefits	.271[c]	.043	-.167	.022
Degrees of Freedom	60	44	97	99

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

APPENDIX M

MULTIPLE REGRESSION ANALYSES OF SOCIO-DEMOGRAPHIC EFFECTS ON PRIVATE BENEFIT-COST RATIOS FOR EACH PROGRAM

	Auto Mechanics		Air Conditioning		Practical Nursing		Cosmetology	
	b[1]	(S)[2]	b	(S)	b	(S)	b	(S)
Regions								
North Florida								
Central Florida	.43[c]	(.17)	1.58[a]	(.42)	.12[d]	(.07)		
Southwest Florida[3]								
Southeast Florida					-.28[a]	(.07)		
Related Working Experience								
Relatedness Index			-.91[d]	(.48)	.25[c]	(.12)	.29	(.19)
Additional Training					-.11	(.07)		
Additional Related Training	.70[b]	(.24)					-.54[c]	(.21)
Race								
White								
Nonwhite[3]	.43[d]	(.25)	1.28[d]	(.77)	.09	(.09)		
Secondary Student	.71[a]	(.19)						
Father Lived with Family	-3.62[a]	(.53)	-3.14[b]	(1.15)			.15[d]	(.08)
Marital Status								
Single								
Married								
Separated, Widowed, or Divorced[3]							.11	(.08)
Father's Annual Income Data	3.31[a]	(.54)						
Father's Annual Income								
Up to $4,000[3]								
4,001 to 5,000								
5,001 to 6,000			2.62[c]	(.99)				
6,001 to 7,000			1.36[d]	(.69)				
7,001 to 8,000								
8,001 to 9,000								
9,001 to 10,000	-.39	(.29)					.30[c]	(.12)
10,000 or Above	.41[c]	(.20)	1.08	(.55)	-.23	(.17)	.22	(.16)
Hours of Attendance							.16	(.10)
Employed During Training					.001[a]	(.00)		
Involuntary Unemployment								
Age					-.08[a]	(.01)		
Number of Children	.11	(.02)	.03	(.02)			.03[b]	(.01)
High School Grade Point Average	.46[a]	(.21)			-.05[c]	(.02)		
High School Level Completed							.12	(.08)
Father's Education					.16[b]	(.06)		
Mother's Education	.08[c]	(.04)	.26[b]	(.11)				
			-.35[b]	(.11)	-.02	(.02)		
Number of Observations	62		46		99		101	
Coefficient of Determination	.74		.79		.59		.35	
Mean of the Dependent Variable	.45	(.93)	1.67	(2.15)	.37	(.41)	.13	(.40)
Intercept Term	-5.04		7.31		-1.21		-2.89	

[a]Significant at .001 level.

[b]Significant at .01 level.

[c]Significant at .05 level.

[d]Significant at .10 level.

[1]b is the regression coefficient

[2](S) is the standard error of the regression coefficient

[3]This regressor of the variable enters into the intercept term. The other regressors of the variable are interpreted at deviations from this regressor.

BIBLIOGRAPHY

Associated Consultants in Education, Inc. "Current Operating Costs, 1970-1971, Florida Area Vocational/Technical Centers." Report to the Florida Division of Vocational, Technical and Adult Education, Tallahassee, Florida, April 30, 1972. Tallahassee: author, 1972.

Becker, Gary S. "Investment in Human Capital: A Theoretical Analysis." Journal of Political Economy, LXX (Supplement, October, 1962), 9-49.

Carroll, Adger B., and Ihnen, Loren A. "Costs and Returns for Investments in Technical Schooling by a Group of North Carolina High School Graduates." Economics Research Report No. 5. Department of Economics: North Carolina State University, December, 1967.

Corizzini, Arthur J. "The Decision to Invest in Vocational Education: An Analysis of Costs and Benefits." Journal of Human Resources, III (Supplement, Fall, 1968), 88-120.

_____. "When Should Vocational Training Begin?" Madison, Wisconsin: Center for Studies in Vocational and Technical Education, University of Wisconsin, 1968.

Eckstein, Otto. "A Survey of the Theory of Public Expenditure Criteria." Public Finance: Needs, Services and Utilization. A Conference of the Universities. Princeton, New Jersey: Princeton University Press, 1961.

Florida. Annual Report of the Florida State Advisory Council on Vocational, Technical Education. 1971.

Florida. Florida State Plan for the Administration of Vocational Education. Parts I, II, and III. 1971.

Florida. Finance and Taxation: Schools, Statutes (1971), Vol. I.

Fogel, Walter. "The Effects of Low Educational Attainment on Incomes: A Comparative Study of Selected Ethnic Groups." The Journal of Human Resources, I (Fall, 1966), 22-40.

Harris, Marshall A. "Cost-Benefit Analysis of Occupational Training Programs." Perspectives on Progress: Career Education in Florida. Edited by Richard H. P. Kraft. Report to the Florida Department of Education, Tallahassee, Florida, 1971. Tallahassee: The Florida State University, 1971.

Kaufman, Jacob J., et al. "A Cost-Effectiveness Study of Vocational Education: A Comparison of Vocational and Non-Vocational Education in Secondary Schools." Report to the U.S. Office of Education, Washington, D.C., March, 1969. University Park: Pennsylvania State University, 1969.

_____. "Cost-Effectiveness Analysis as a Method for the Evaluation of Vocational and Technical Education." Paper presented at the National Institute for Improving Vocational Education Evaluation, University of Arkansas, August 4-8, 1969.

Kraft, Richard H. P. "Cost-Effectiveness Analysis of Vocational-Technical Education Programs." Report to the Florida State Department of Education, Tallahassee, Florida, June, 1969. Tallahassee: The Florida State University, 1969.

Prest, A. R. and Turvey, Ralph. "Cost-Benefit Analysis: A Survey." The Economic Journal, LXXV (December, 1965), 684-735.

Raichle, Henry. "A Cost-Utility Analysis of a Selected Post-Secondary Vocational-Technical Education Program." Unpublished Ph.D. dissertation, The Florida State University, 1969.

Renshaw, E. F. "Estimating the Returns to Education." Readings in the Economics of Education. Edited by Mary Jean Bowman. Paris: United Nations, Educational, Scientific and Cultural Organization, 1968.

Schultz, Theodore W. The Economic Value of Education. New York: Columbia University Press, 1963.

Spiegelman, Robert C. "A Benefit-Cost Model to Evaluate Educational Programs." Socio-Economic Planning Sciences, I (1968), 443-60.

U.S. Department of Labor. Manpower Report of the President, 1972.

Weisbrod, Burton A. "Conceptual Issues in Evaluating Training Programs." Monthly Labor Review, LXXXIX (October, 1966), 1091-1097 .

_____. "Education and Investment in Human Capital." Journal of Political Economy, CIX (Supplement, October, 1962), 106-123.

Wiseman, Jack. "Cost-Benefit Analysis in Education." Southern Economic Journal, XXXII (July, 1965), 1-12.